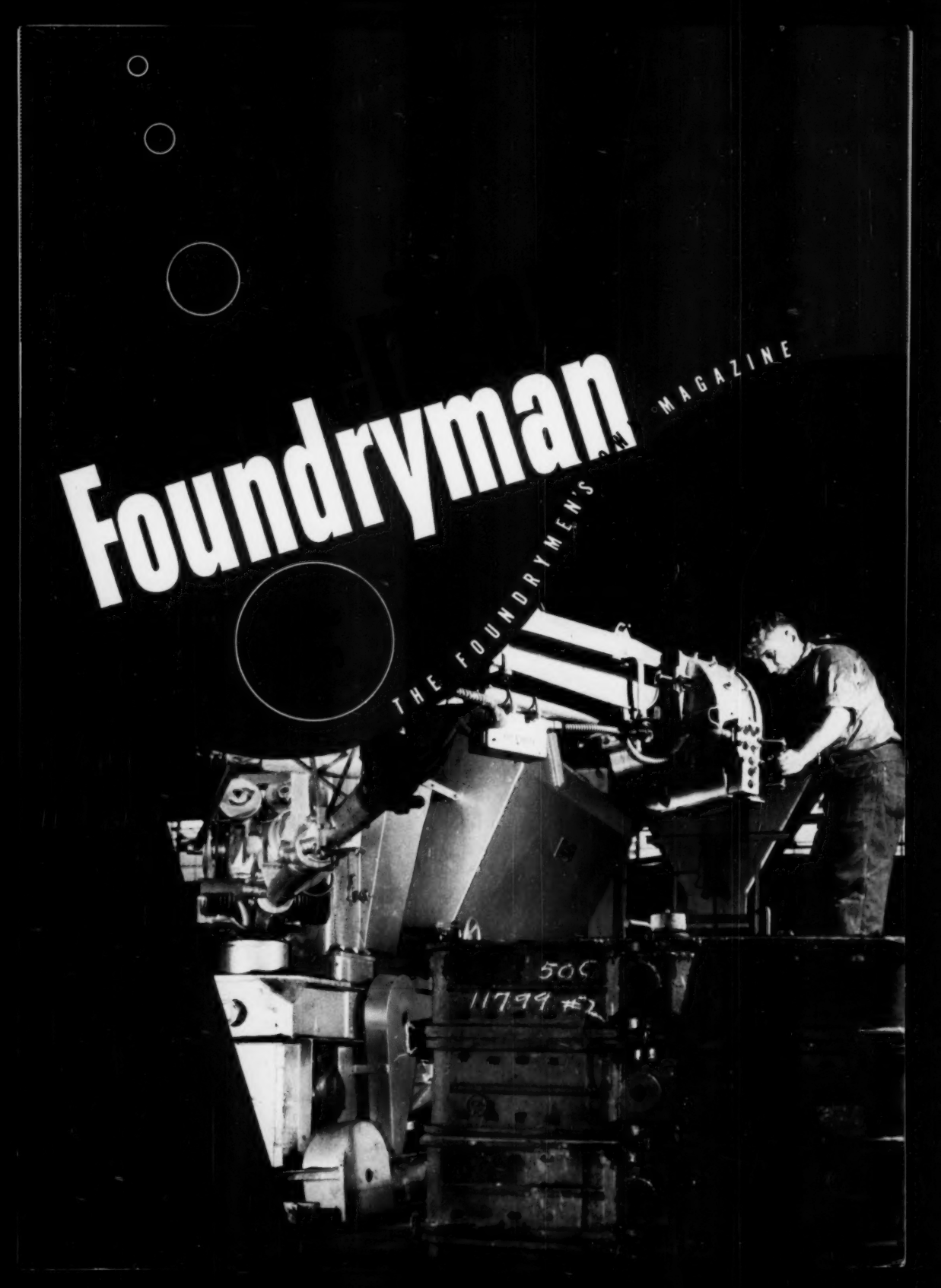
Foundryman

THE FOUNDRYMEN'S MAGAZINE



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so **Lectromelt**

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Those wide open spaces under Lectromelt Furnaces were put there with a purpose. No clogging of gears, no damaging of motors when molten metal spills or the inevitable burn-through happens. Moore, inventor of the Rapid Lectromelt Furnace, forestalled that hazard many years ago, just as he anticipated many others in operating electric arc furnaces.

Structurally, Lectromelt Furnaces are husky. Accessories are built generously. Power transformers and electrical equipment allow for heavy overloads. That's why we sell so few replacement parts; why Lectromelt Furnaces cost less to operate.

Whether your work calls for melting, refining, smelting or reduction, Lectromelt engineers can advise you on methods and equipment to do the job. For this help, and for Bulletin No. 7 telling you more about Lectromelt Furnaces, write Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in... CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham... SWEDEN: Birlec Elektkougnar A/B, Stockholm . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa.

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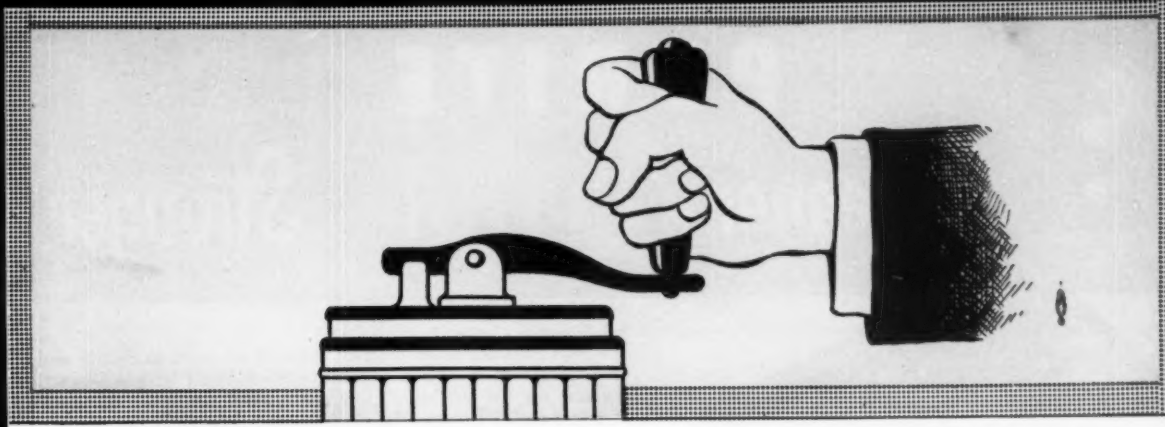

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June, 1950

Official publication of American Foundrymen's Society

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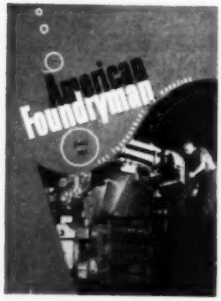

Ramming large floor mold with mechanical molding equipment in spacious $3 million high alloy foundry of Electro Alloys Div., American Brake Shoe Co., Elyria, Ohio. Molding equipment ranges from large jolt rollover machines to small jolt squeeze machines for snap molds.

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U. S., Canada and Mexico, $3.00 per year; elsewhere, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois. EASTERN REPRESENTATIVE—Warren Thomson Mayers Co., 130 East 61st St., New York. CENTRAL REPRESENTATIVE—Frank J. Enright, 16718 Kenyon Road, Cleveland. MIDWESTERN REPRESENTATIVE—L. F. McClure & Associates, 814 N. Tower Court, Chicago.

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NOTE

"Proper Melting Decreases Foundry Losses," contains interesting data. Also, the booklet, "Nonferrous Ingot Metals of Today." Write for both of these. They are free.

Successful foundrymen deoxidize or "clean up" molten metal by a scientific method worth using *as indicated:*

They use phosphorus . . expertly . . in the form of "Ajax Phosphor Copper" . . added as the crucible is removed from the furnace . . for virtually all brass and bronze alloys.

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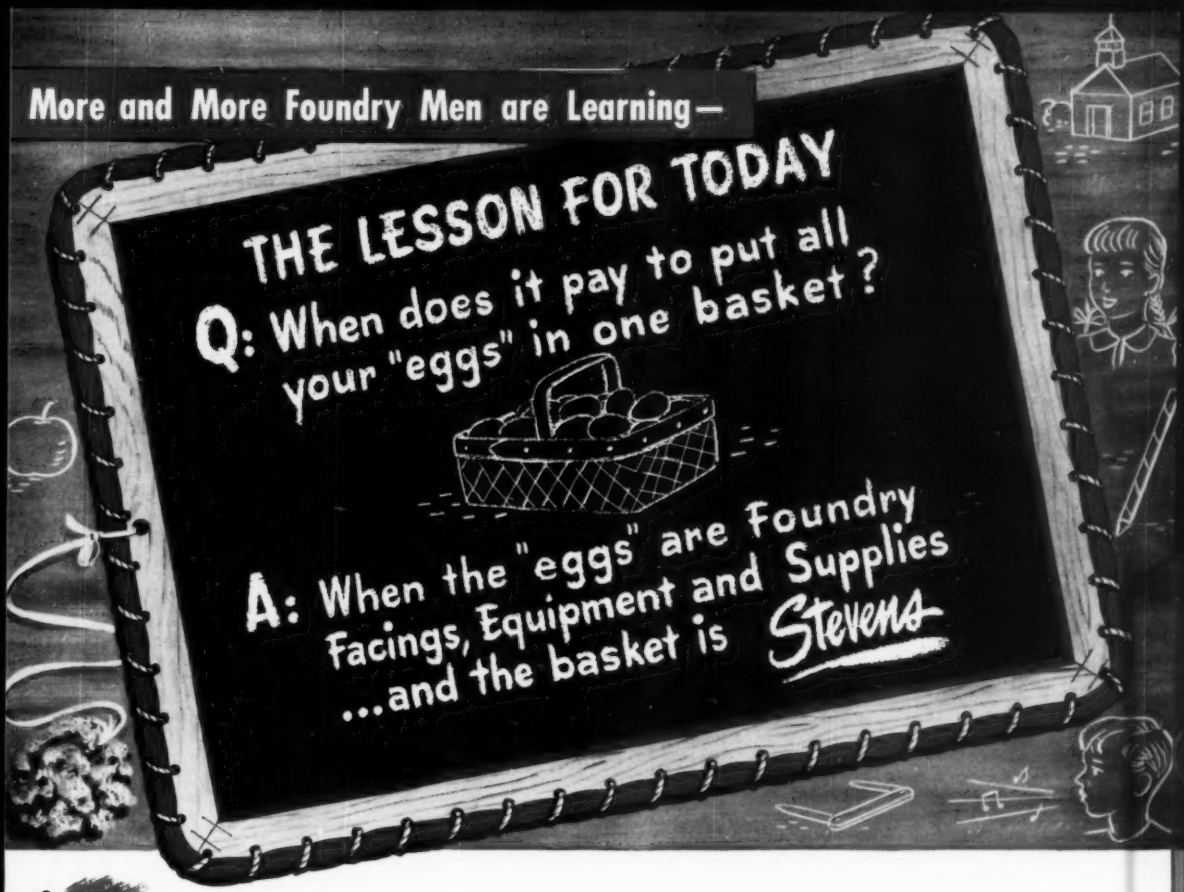
THE LESSON FOR TODAY
Q: When does it pay to put all your "eggs" in one basket?
A: When the "eggs" are Foundry Facings, Equipment and Supplies ...and the basket is Stevens

You aren't apt to find this lesson in any book on modern foundry practice. Only knowledge born of experience can prove the wisdom of concentrating the bulk, if not *all* of your foundry equipment and supply purchases with one dependable source. For many production-minded, cost-conscious foundry operators this experience is a revelation when the "source" is Stevens.

Not only does *one source of supply* simplify engineering and purchasing problems, but *one responsibility* for all necessary equipment and supplies delivered to the job, assures you of getting a better installation and avoids needless delays. The *high quality* of each item sold by Stevens, be it equipment or a barrel of core coating, is your assurance of utmost efficiency and absolute dependability in every phase of your foundry operation.

When you consult with a Stevens Sales and Service representative you have a direct line to fast action on your foundry problems. For Stevens is an *integrated* company. Sales, metallurgy, production and shipping are closely coordinated to provide you with on-the-spot information, quick decisions and great flexibility in helping you produce better castings faster, at less cost. If it's *anything* for a Foundry—Stevens has *everything* you need!

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ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How to Control Composition of Cast Iron With Silicon and Manganese Briquets

Control of the composition of cupola-melted cast iron becomes a simple matter through the use of alloy briquets.

These briquets make the old practice of blending two or three pig irons of high and low silicon and manganese contents, to produce a desired composition, both unnecessary and undesirable. A single grade of pig iron can be stocked, and any desired composition in the product can be obtained, simply and economically, by the addition of silicon and manganese briquets.

Function of Silicon in Iron

In cast iron, silicon acts as a deoxidizer and graphitizer. It promotes the formation of flake graphite and softens the iron.

When either the carbon or silicon content of an iron is too low for the section thickness involved, the result will be the formation of chilled spots (iron carbide) at corners and in other rapidly cooled locations. This has an adverse effect on the machinability of the iron and the life of the tools used to machine it. On the other hand, excessively high carbon or silicon content in heavier sections results in open-grained iron that is both soft and weak.

How Silicon Aids Carbon Control

A rather definite relationship exists between the silicon level in a pig iron and its carbon content, as shown in Figure 1.

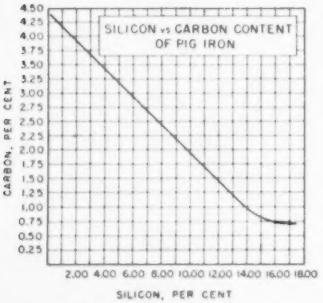


Fig. 1—Relation of silicon and carbon content in pig iron. Notice that the carbon level gradually decreases as the silicon is increased.

As indicated in this chart, an increase in the silicon content of a pig iron has a decided effect in lowering its carbon content. When producing soft iron, where it is desirable to hold the carbon on the high side, pig iron running in the range of 2.0 per cent silicon is desirable in the cupola charge, rather than the higher silicon grades of pig sometimes used in these irons. The additional silicon needed to meet the desired chemical analysis can be easily and economically added to the charge in the form of silicon briquets. This provides an economical and flexible system of chemical control.

Function of Manganese in Iron

Manganese acts as a scavenger to deoxidize iron. As an alloying element, it imparts density and high strength. It combines with sulphur to form manganese sulphide, which does not have the harmful characteristics of the iron-sulphide inclusions that form when manganese is not present. A manganese-sulphur ratio of 6:1 is suggested.

Briquets Give High Alloy Recovery

Silicon and manganese briquets are available from ELECTROMET in the sizes shown in Table I. These "EM" briquets are all made with a binder that prevents oxidation until the alloy unites with the iron in the melting zone of the cupola. Thus, the recovery of alloy is high—usually over 90 per cent for silicon and about 85 per cent for manganese.

More Scrap, Less Pig in Charge

Foundries can use an increased amount of scrap in the charge because the analysis of the iron can be adjusted by adding "EM" briquets. This reduces material costs and makes possible substantial savings in cupola operation.

Booklet Available

Further information is given in our booklet, "Briquetted Alloys For The Iron Foundry Industry." To obtain a copy, free of charge, write or phone our nearest office: in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, or San Francisco.

The terms "EM" and "Electromet" are registered trade-marks of Union Carbide and Carbon Corporation.

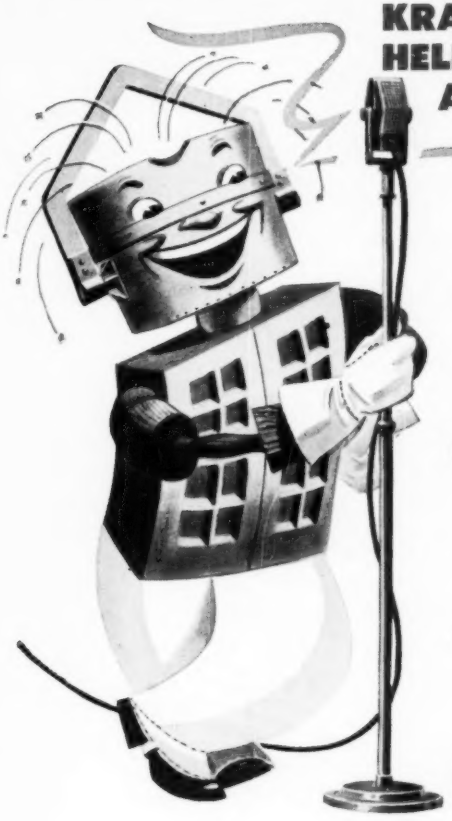
Table I. "EM" Briquetted Alloys for Cupola Additions

Type of Briquet	Gross Weight	Alloy Content
"EM" Silicon Briquets (two sizes) Round	5 lb.	2 lb. Silicon
	2½ lb.	1 lb. Silicon
"EM" Silicomanganese Briquets Square	3½ lb.	½ lb. Silicon 2 lb. Manganese
"EM" Ferromanganese Briquets Oblong	3 lb.	2 lb. Manganese

Table II. Typical Briquet Mixture for Soft Gray Iron

Base Charge			Alloys in Charge Material			
			Silicon		Manganese	
Per Cent	Lb.	Material Charged	Per Cent	Lb.	Per Cent	Lb.
40.0	400	Pig Iron	2.25	9.00	0.75	3.00
40.0	400	Return Scrap	2.50	10.00	0.65	2.60
20.0	200	Purchased Scrap	2.28	4.56	0.55	1.10
100.0%	1,000 lb.	Total Base Charge		23.56		6.70
Briquets Required		4 Small Silicon Briquets		4.00		—
		½ Silicomanganese Briquet		0.25		1.00
		Total Alloys Charged		27.81 lb. Si or 2.78% Si		7.70 lb. Mn or 0.77% Mn
		Melting Recovery Factor		x .90		x .85
		Final Analysis of Iron		2.50% Si		0.65% Mn

Calling All Core-Makers...



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ENGINEERING COMPANY

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Mr. John D. Murray, Adv. Mgr.
American Foundryman
222 W. Adams St.
Chicago 6, Ill.

Dear Mr. Murray:

Enclosed is a schedule of advertisements that our company has decided upon for American Foundryman. Frankly, we are very pleased with results to date. Coupons have been coming in consistently, and we are checking these carefully to gauge the market.

Of those received so far, American Foundryman has a distinct edge in the number of inquiries, with the advantage of an average ratio of 2 to 1 in sales over other publications.

It is on this record that we have decided to expand the schedule, per the enclosed.

Very truly yours,

MARTIN ENGINEERING COMPANY

E. F. Peterson

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EFP/...

There is no mistaking results and, from the tone of the letter reproduced here, there is no mistaking the fact that AMERICAN FOUNDRYMAN, judged in terms of results, is the leading sales producer for the marketing of foundry equipment and supplies.

Yes, you've seen this advertisement reproduced in the pages of media reaching the foundry field, and you will be interested to know that the advertiser has kept a close tally on returns. The outcome was conclusive . . . AMERICAN FOUNDRYMAN **outpulled other magazines 2 to 1** in completed sales! This can mean only one thing—AMERICAN FOUNDRYMAN is the magazine that manufacturers can depend upon for results . . . **the kind of results that mean profitable advertising.**

AMERICAN FOUNDRYMAN can "pull" equally as many returns for those firms whose products are suited for use by the thousands of subscriber-members who regularly look to **The Foundrymen's Own Magazine"** as a reliable source of information on the development and production of cast metals.

If AMERICAN FOUNDRYMAN isn't already scheduled for your 1949-50 sales program, it is only **good business** to do so immediately—it costs less than 2c per prospect to reach the readers of AMERICAN FOUNDRYMAN each month with an ad similar to the one reproduced above. Send for full details today!

...an Foundryman

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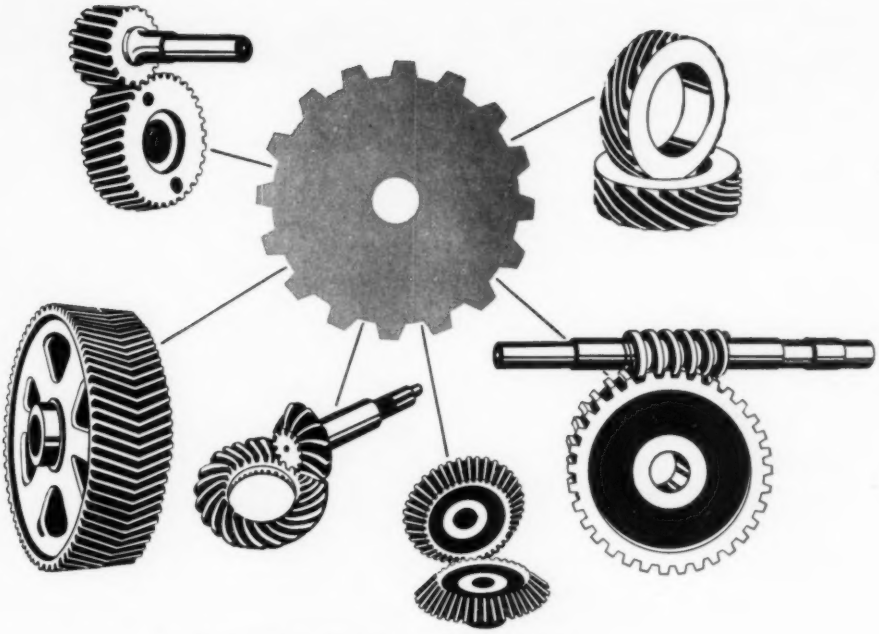
Chicago 6, Ill.



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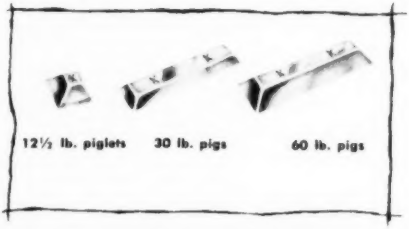

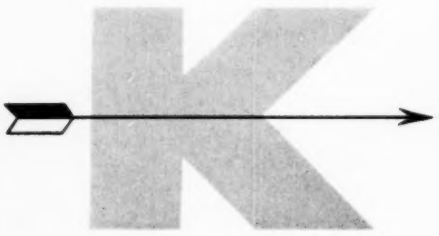

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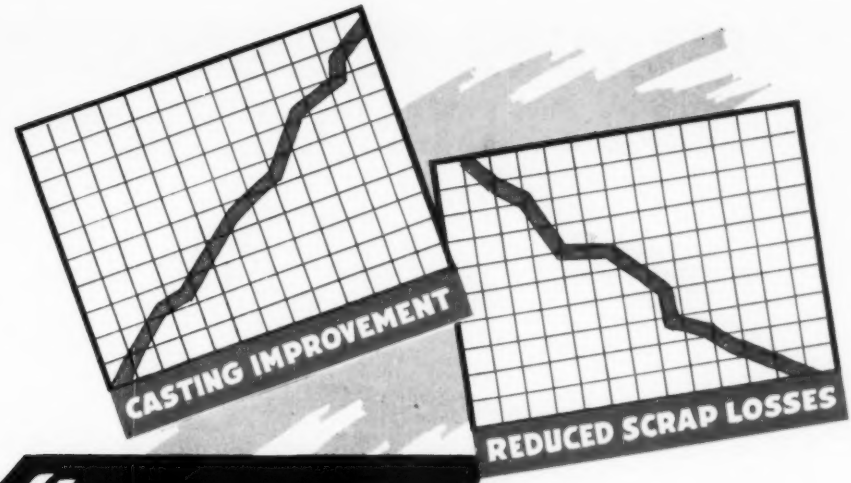


You can gain Both -- the answer is Famous CORNELL CUPOLA FLUX

HUNDREDS of leading foundries have fallen in line with regular users of Famous Cornell Cupola Flux. *By improving their castings, they avoid many rejects and make better deliveries.*

Famous Cornell Cupola Flux purifies molten metal, makes it more fluid and reduces sulphur.

It greatly reduces chilled sides, hollow centers and hard spots in castings. Improves machinability.

It keeps cupolas and drops cleaner, protects lining life and reduces maintenance.

EASIEST FLUX TO USE. You simply lift it out of container and toss it into cupola with each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

WRITE FOR BULLETIN NO. 46-B

MALLEABLE FOUNDRIES, with cupola operation, are showing a rapid trend towards the use of Famous Cornell Cupola Flux. Reports of greatly improved casting production come from every direction. Furthermore, there is a considerable reduction in cupola maintenance labor and cost. The life of cupola lining, whether brick or stone, is greatly prolonged.

SCORED BRICK FORM

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

The CLEVELAND FLUX Co.
1026-1040 MAIN AVENUE, N. W.
CLEVELAND 13, OHIO
Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum Flux Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

HOW YORK CORPORATION CUTS CASTING REJECTS

YORK CASTS THOUSANDS OF PARTS LIKE THESE IN NICKEL CAST IRON

Famous for refrigeration and air conditioning, York has installed a greater aggregate capacity of mechanical cooling for commercial use than any other manufacturer. York not only insures their high reputation by use of long-wearing Nickel cast iron parts, like those shown here, but also gains production economies through the superior machining qualities of Nickel cast iron.

A foundry producing as many castings as York Corporation can't afford a high percentage of rejects . . .

That's why York uses Nickel to keep quality up, costs down, and to minimize rejects in both the foundry and machine shop.

After testing cast irons of all types, York's engineers virtually standardized on Nickel cast iron because it provides consistently strong, fine-grained castings, free from porosity and brittleness, and readily machinable in the shop.

York's experience is typical of hundreds of other foundries now using Nickel cast iron to secure these basic advantages:

IN THE FOUNDRY –
By minimizing rejects, Nickel raises man-hour output and correspondingly cuts down the time, labor and money lost by replacing such rejections.

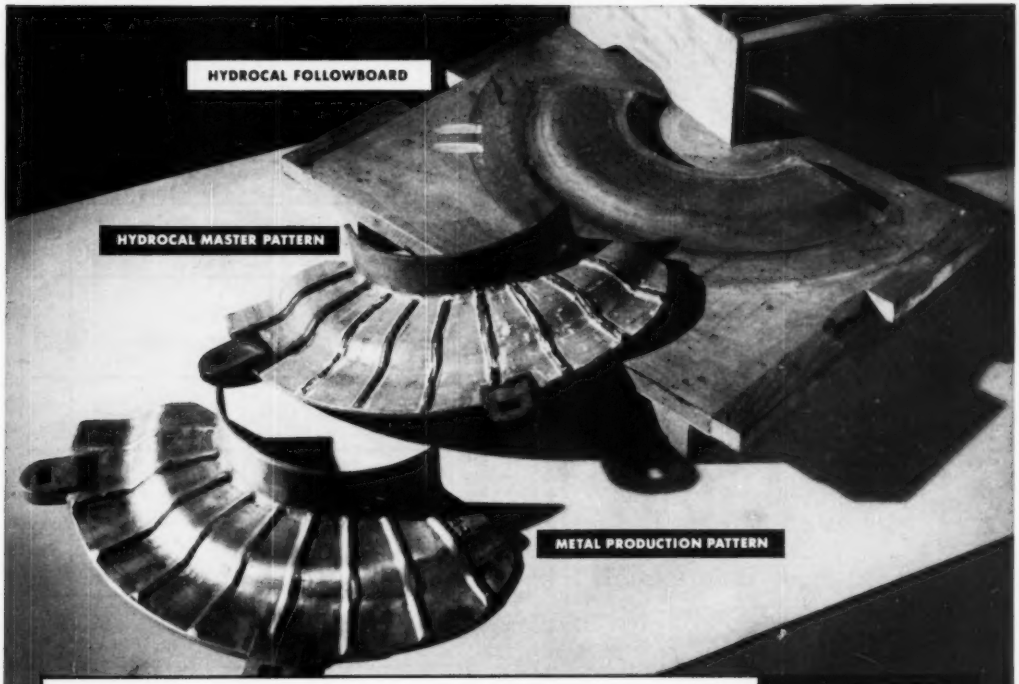
IN THE MACHINE SHOP –
Nickel cast iron also cuts rejects here, because the improved structure and uniformity of the metal provides sound castings that can be easily machined to a smooth finish.

IN SERVICE LIFE –
Nickel cast iron parts provide exceptional wear-resistance that assures long, trouble-free performance for the ultimate consumer.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.



Blueprint to Production Pattern—only 11½ hours!...Thanks to outstanding

ADAPTABILITY

The HYDROCAL* master pattern and the aluminum production pattern were made at the Southern Precision Pattern Works, Birmingham, Alabama—important users of HYDROCAL Gypsum Cements.

HYDROCAL Gypsum Cement was chosen for this job because its ready adaptability to complex and irregular shapes meant savings in time and money. Both the HYDROCAL master and the aluminum production pattern were made in less time than is usually required for a single master pattern made by conventional methods.

*HYDROCAL and HYDROSTONE are trademarks reg. U. S. Pat. Off. for super-strength gypsum cements manufactured by U. S. Gypsum Co.

TYPES OF HYDROCAL FOR PATTERN SHOPS

Pattern Shop HYDROCAL, general purpose gypsum cement.

HYDROCAL B-11, for built up or template formed models or patterns.

*HYDROSTONE**, hardest and strongest gypsum cement for duplicate patterns. Must be cast. Cannot be worked under template.

High Expansion HYDROCAL, to expand dimensions of a pattern to compensate for metal shrinkage.

United States Gypsum

For Building • For Industry

Gypsum • Lime • Steel • Insulation • Roofing • Paint

In Canada, CANADIAN GYPSUM COMPANY, Limited
170 Bloor St., West, Toronto, Ontario

mail this coupon NOW for latest bulletins

UNITED STATES GYPSUM COMPANY
Dept. AF-6-50, Chicago 6, Illinois

Gentlemen:

Please send me copies of your latest bulletins as checked below.

- ☐ IGL-103, How to Make Pattern Stock with HYDROCAL Gypsum Cement.
- ☐ IGL-104, How to Check a Core Box with HYDROCAL Gypsum Cement.
- ☐ IGL-105, How to Make a HYDROCAL Gypsum Cement Follow Board.
- ☐ IGL-106, HYDROCAL Gypsum Cement Combined with Blended Shapes.
- ☐ IGL-107, How to Make a Core Box with HYDROCAL Gypsum Cement.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

HERE'S A SPECIAL DEPARTMENT THAT YOU SHOULD KNOW ABOUT

FROM time to time an unusual group of specialists and engineers in our plant render a unique service to the Automobile, and Allied Industries by designing and process engineering special equipment planned and fitted to their individual custom requirements.

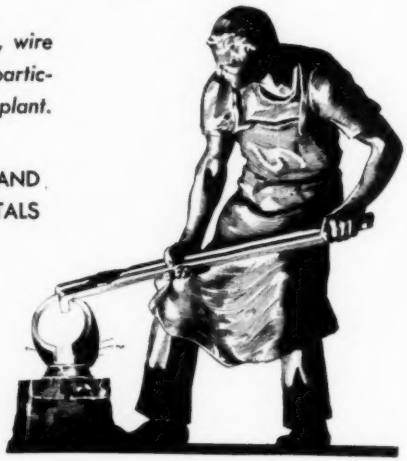
✓ Check this list of the many special custom orders we are in a position to handle in a prompt, economical manner.

CORE WIRE BENDING FIXTURE *(Air operated)*	
CORE WIRE BENDING DIES	
CORE DRAWING FIXTURES	
CORE GRINDING FIXTURES *(multiple grinding operation)*	
CORE TRIMMING FIXTURES (Contour)	
CORE PASTING FIXTURES	
CORE LOADING FIXTURES	
CORE SETTING FIXTURES	
CORE SETTING GAGES	
CORE CHECKING GAGES	
CASTING CHECKING GAGES	
CASTING "WATER TEST FIXTURES"	

Our Designers and Engineers cordially invite you to write, wire or phone us for complete information covering your own particular problems, or to request a personal interview at your plant.

ETERNA METAL

PERMANENT MOLDS · WOOD AND METAL PATTERNS · KELLER AND DUPLICATOR WORK · MACHINE WORK · MALLORY METALS BERYLLIUM COPPER · MONEL METAL · EVERDUR CASTINGS COPPER CASTINGS OF HIGHEST ELECTRICAL CONDUCTIVITY · BRASS, BRONZE AND ALUMINUM CASTINGS



CITY PATTERN
FOUNDRY AND MACHINE CO.

1161 HARPER AT RIVARD · DETROIT 11, MICHIGAN

MEXITE BRIQUETTES

FOR CARBON CONTROL IN THE CUPOLA

Replace carbon usually provided by pig iron. Supply a uniform steady source of graphitic carbon. Enable better castings to be poured from 100% scrap charges. Raise carbon, thus reducing chill, shrinkage and hardness and increasing fluidity and machinability.

Easy to use.

THE UNITED STATES GRAPHITE COMPANY

Division of The Wickes Corporation • Saginaw, Michigan

Eliminate **ASH AND FREE CARBON**

with....

DELTA PERMI-BOND*

THE MODERN, SCIENTIFIC SEACOAL REPLACEMENT

DELTA PERMI-BOND is a specially prepared pure hydrocarbon, completely volatile at elevated temperatures. It decomposes to form a vapor-gas cushion, which is reducing in nature, and leaves only a trace (two tenths of 1% maximum) of ash.

Do not confuse DELTA PERMI-BOND with other sand additives or so-called "chemical sand-coating" cure-alls which may consist mainly of asphalt, or other petroleum by-product pitches dissolved in fuel oil or other solvents. DELTA PERMI-BOND is a scientific development protected by United States patents allowed.

*Licensed for foundry use under U. S. Patent 2256832.

NINE IMPORTANT ADVANTAGES

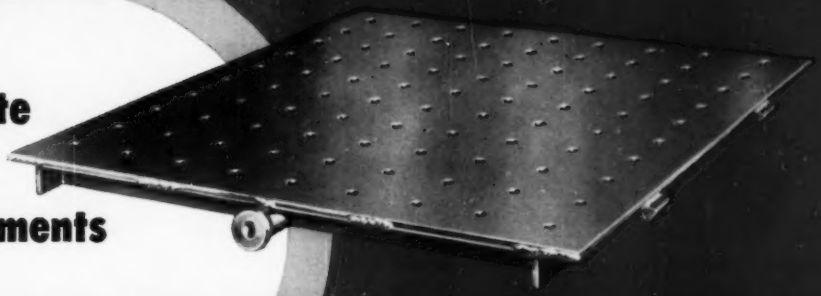
1. Always uniform. Manufactured under rigid chemical and physical control.
2. Eliminates ash and free carbon which contaminate your sand.
3. Greatly reduces gas, smoke, soot and dirt in the foundry.
4. Provides correct amount of vapor gas in the mold cavity which allows use of lower permeability sand without casting blows.
5. Increases dry strength properties of sand.
6. Prevents scabbing, buckling, rat-tailing and cutting, greatly reducing scrap castings.
7. Improves casting finish . . . cuts cleaning room costs to a minimum.
8. More economical to use: cuts sand costs.
9. Much cleaner, more foolproof than seacoal.

DELTA OIL PRODUCTS CO.

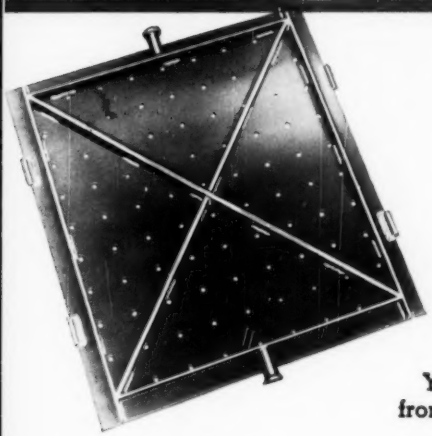
MILWAUKEE 9, WISCONSIN

Buy 'em Once...Use 'em ALWAYS

Eliminate Costly Replacements with

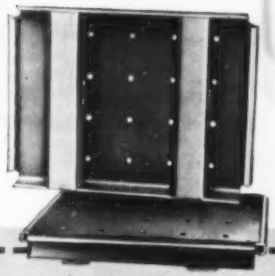


BS&B STEEL BOTTOM BOARDS and CORE PLATES



• Yes, sir . . . your foundry is protected against crucial burn outs and breakdowns when BS&B Steel Bottom Boards and Core Plates are on the job! Use 'em, abuse 'em . . . BS&B builds 'em to take it and beg for more. They last and last and last! Like famous BS&B Flasks, each Bottom Board and Core Plate is a precision-built product. Welded throughout for strength . . . but welding is kept to a minimum to avoid warpage. Finished boards are surface ground to insure perfect level. Or they can be machined for even greater accuracy, if desired.

Your specifications can be met easily from a complete selection of sizes and types, heavy duty (above) or light-weight (right). Firmly braced, perforated . . . accessories such as trunnions, clamp lugs available.



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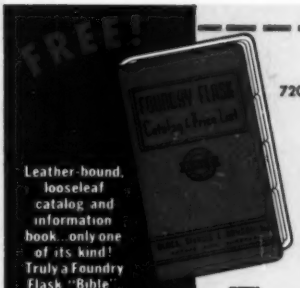

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BLACK, SIVALLS & BRYSON, INC.
720 Delaware Street — Kansas City 6, Missouri
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MOGUL CUTS DOWN DISCARDS

LARGEST SELLER IN THE FIELD

MOGUL cuts drying time

MOGUL makes smoother cores

Full technical service, without obligation, is available to show how you can profit from the use of MOGUL Cereal Binder in your production.

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CORN PRODUCTS
REFINING COMPANY
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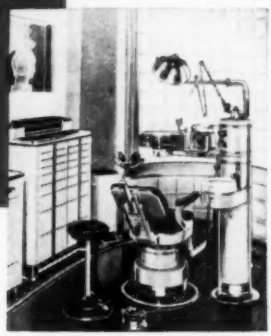
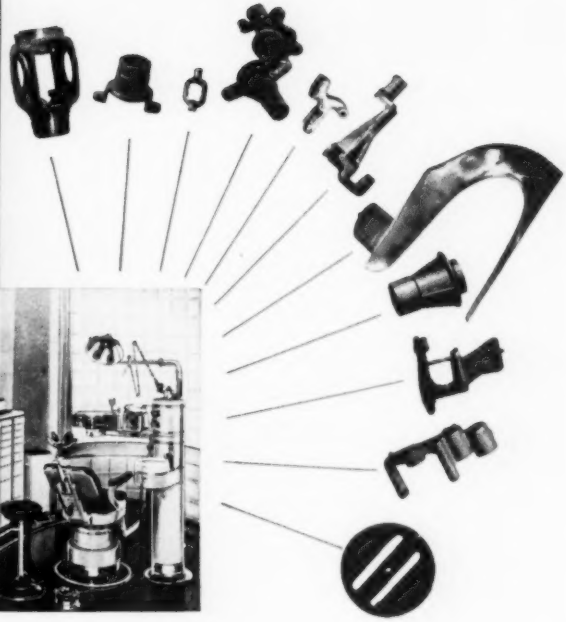
—— *the preferred dry bond for cores*

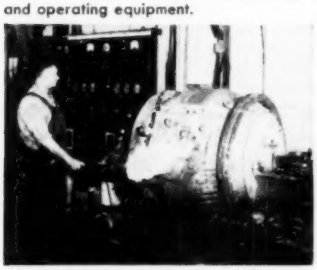
HOW MANY CASTINGS in a DENTIST'S EQUIPMENT?





S.S.WHITE makes 'em all with DETROIT ROCKING ELECTRIC FURNACE melts

S. S. White Dental Manufacturing Company, in its Staten Island plant, makes everything a dentist needs. A great many castings go into the making of chairs, tables, control and operating equipment.



Type LFC Detroit Rocking Electric Furnace. Capacity 350 lbs., melting nickel alloy iron.

All metal used in this wide variety of precise castings is melted in Detroit Rocking Electric Furnaces.

Read the Advantages!

Here are the advantages that Detroit Electrics deliver at S. S. White: Better control of analysis. Smoother surface finish—important because many of the castings are enamelled or chrome plated. Accurate temperature control. Added gains are cleaner operation, improved working conditions, and savings in floor space.

You, too, may well profit from Detroit Rocking Electric Furnaces. You can get better castings, fewer rejects, higher usable yields, faster melts. Electrodes are always clear of the molten bath, eliminating carbon pickup. Indirect arc and automatic electrode adjustment assure optimum power use.

Linings of these great furnaces last longer. Replacement linings, when necessary, are quickly installed.

Get the Facts

For ferrous or non-ferrous metal melting, Detroit Rocking Electric Furnaces have much to offer you. Send us your production data. Our engineers will give you the facts on the benefits that can be yours.

Capacities from 10 to 4000 lbs. Conical or cylindrical chambers.

WRITE TODAY!

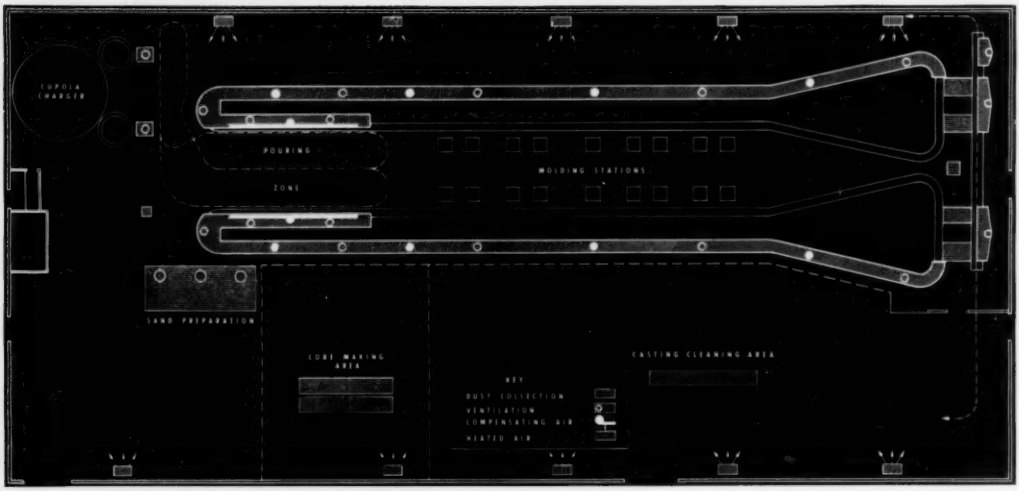
DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.

A bvb Solution by Schneible

ACTUAL PLANT LAYOUT OF BUILDING VENTILATION BALANCE



BUILDING VENTILATION BALANCE
(An Actual BVB Installation)

DEPARTMENTS	EXHAUST		SUPPLY		% of Total Air Saved
	Dust Collector	Ventilation	Heated	Compensating	
MOLD UNITS					
Pouring		90,000 cfm		62,000 cfm	68%
Mold Conveyor		120,000		88,000	73%
Shakeout	40,000 cfm				
Casting Conveyor Load		8,000			
Sand Handling and Preparation	21,000	5,000			
Other		25,000			
CLEANING ROOM					
Abrasive Cleaning	7,500				
Tumbling	4,500				
Grinding	10,000				
Casting Sorting (Hot)		11,000			
CORE ROOM					
Mixers	2,500				
Ovens		9,200			
Other		2,400			
MELT DEPARTMENT					
Cupola Spout and Ladle		10,000			
Charging Door (Losses)		20,000			
Cupola Blower		8,000			
Other		5,000			
GENERAL					
Heated Air Supply			264,100		
Miscellaneous Losses		40,000			
Miscellaneous Sources				25,000	
TOTALS	85,500 cfm	353,600 cfm	264,100	175,000 cfm	49%

SAVINGS ARE HERE AS AIR IS NOT HEATED

TOTAL EXHAUST 439,100
TOTAL SUPPLY 439,100

bvb

The *b v b* layout above was developed by Schneible engineers for a large Eastern foundry.

All hoods were located for maximum efficiency in ventilation and dust control. Unit heaters in outside walls furnish right amount of heated air which when combined with the compensating air equals the total air exhausted through dust collectors and ventilation.

This is b v b *or building ventilation balance and* b v b *allows the same efficient operation of dust and ventilation equipment in both Winter and Summer.*

b v b gives greater economy in the operation of power plant facilities and dust collector capacity in winter, and cleaner, cooler working conditions in summer.

Check your own *b v b*—if you don't find *building ventilation balance*, Schneible engineers can save you money!

PRODUCTS: Multi-Wash Collectors • Uni-Flo Standard Hoods Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods Water Curtain Cupola Collectors • Ductwork • Velocitrap Dust Separators • Entrainment Separators • Settling and Dewatering Tanks • "Wear Proof" Centrifugal Slurry Pumps

CLAUDE B. SCHNEIBLE COMPANY • P. O. BOX 502 • DETROIT 32, MICHIGAN

SCHNEIBLE

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

FERRO SILICON FROM TENNESSEE

Ferro Silicon from Tennessee is supplied in lump crushed sizes and briquette form—in standard or low impurity grades. Standard briquettes in 2½ or 5 pound sizes.

Order your Ferro Alloys in mixed cars of Ferro Silicon, Ferro Manganese and briquettes for freight economy. Let us quote prices on these dependable products.

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Ore & Ferro Corporation, 30 Broad St., New York

TENNESSEE PRODUCTS AND CHEMICAL *Corporation*
NASHVILLE, TENNESSEE

...g the most out of your SIMPSON MIXERS?

bulletin 503

modernize your SIMPSON MIXERS

Reduce Operating Costs and Increase Production by adding latest improvements to your existing mullers

National Engineering Company, Chicago 6, Illinois

THIS NEW BOOKLET WILL SHOW YOU HOW TO CUT COSTS

IF you are looking for ways to increase output and lower production costs *without* purchasing new major equipment, this new booklet will show you how to effect a modernization program in easy, economical steps.

Specifically, this booklet shows you how to bring your Simpson Mixers up to date, through the addition of the newest "National" design and engineering developments.

It is important to remember that you can modernize your existing Simpson Mixers right in your own foundry, with a minimum of labor and expense. Thus, you can restore, or even improve, their original performance without having to purchase entirely new mixers. *Write for your copy of Bulletin 503 today!*

SIMPSON Intensive MIXERS

NATIONAL *Engineering Company*

600 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

5 PRINCIPLES GOVERN ALL A.F.S. ACTIVITY

A TECHNICAL SOCIETY entitled to represent an industry is bound by standards or principles known to all and zealously guarded by its elected officials. These standards stem directly from, and are limited by, its constitutional authority. Thus the distinction of A.F.S. is compounded of five basic principles:

First, it must rely upon the faith and good will of many men, and solicit their active interest.

Men active in Society affairs employ that activity first to help others, and secondly to advance themselves. Herein lies the great importance of a technical society to Management whose personal interests no longer lie in technical affairs. Corporation or industry, both are composed of Men, and on the knowledge of those men depends all foundry progress.

Second, its integrity must be unimpeachable, constant, and proof against any pressure.

AFS is subsidized neither by government nor by private interest. It is owned and operated solely by the Castings Industry, and the men who have been its leaders believe that it should remain so. A.F.S. can act in the interest of all phases of metal casting only because it is financed and governed by all.

Third, it must condition the field it serves to consider and to embrace every potential means of progress.

Every activity of A.F.S. may be termed "a conditioner for progress." Through its papers, publications, Chapter activities, and such Conventions and Exhibits as that held recently in Cleveland, A.F.S. conditions the minds of foundrymen to accept the desirability of plant and process improvement. Men come to realize that the plant that jealously guards its "secret" methods may merely have closed its doors to modern methods.

Fourth, it must advocate nothing but analyze all, selecting for dissemination only that which meets accepted high standards.

No society like A.F.S. can recommend men, materials, or equipment. It can only present, or make it possible to present, verifiable information for acceptance or rejection by those interested. It is, in effect, a forum rather than a rostrum; a meeting place rather than a market place. Since A.F.S. provides the stage, it necessarily sets the rules.

Lastly, it must be prepared to lend its sponsorship to activities which, while outside its own sphere, deserve industry-wide acceptance.

Not widely known are these facts: a Secretary of A.F.S. headed the foundry industry's advisory committee in World War I; in 1937, A.F.S. organized a mutual insurance company to self-insure Illinois foundries against a silicosis racket; most of today's foundry trade associations were born under auspices of this Society. Better known: A.F.S. is a charter member of the National Castings Council, nucleus for the present Foundry Advisory Committee to the Munitions Board; a founder of the Foundry Educational Foundation.

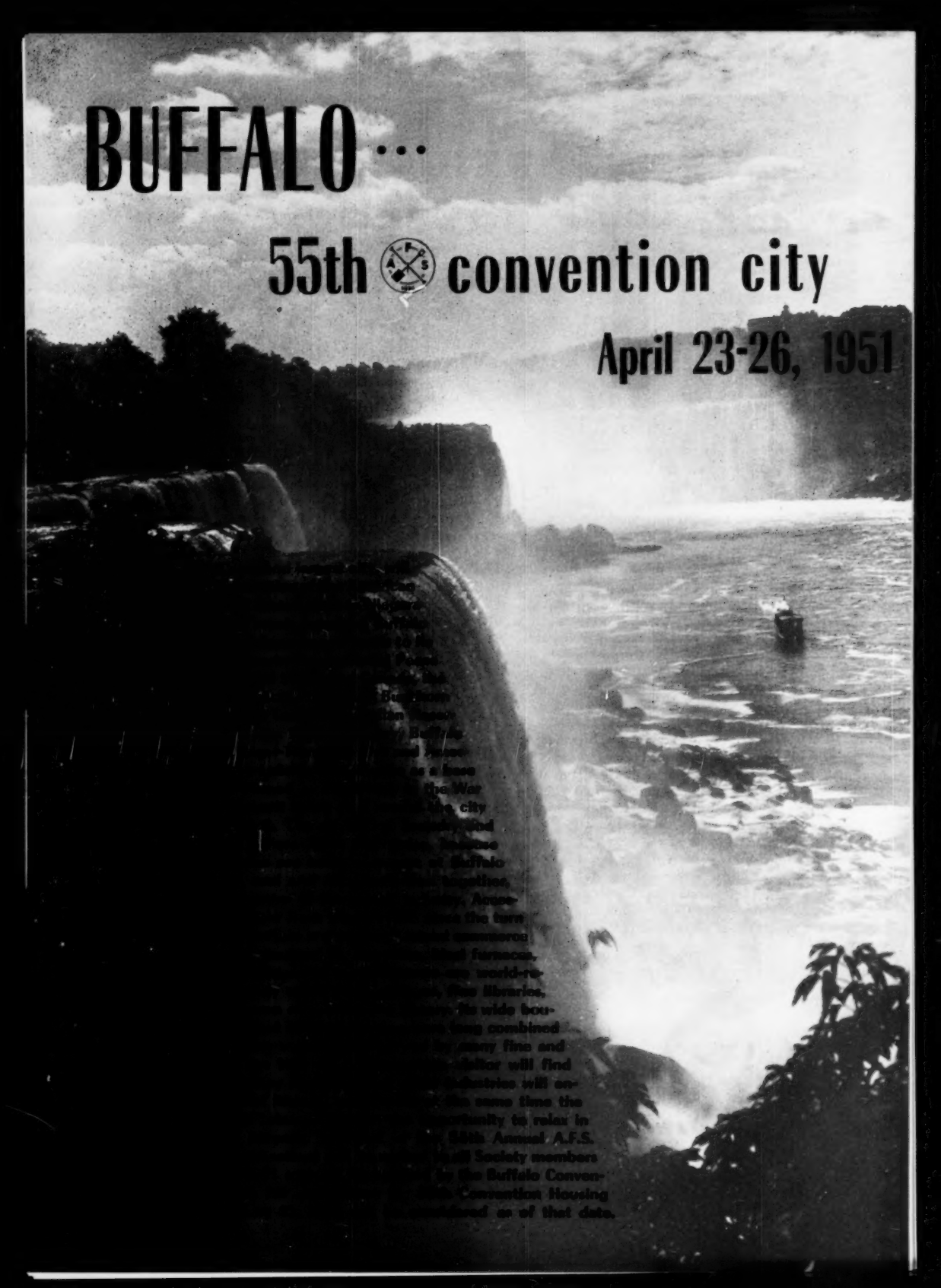
Now the Society is undertaking a strong Safety and Hygiene program for the industry as a whole. Recently, President Horlebein proposed a new project, an industry-wide Castings Promotion program, which the industry, rather than A.F.S. alone, should undertake.

These principles guide the conduct of Society affairs today. Foundrymen should know and understand them; they guarantee to every Society member the opportunity to improve himself in direct proportion to his willingness to learn.

Wm. W. Maloney

WM. W. MALONEY
National Secretary-Treasurer
AMERICAN FOUNDRYMEN'S SOCIETY

Wm. W. Maloney was elected Secretary-Treasurer in July, 1945, succeeding the three previous chief administrative officers—C. E. Hoyt, C. E. Westover, and R. E. Kennedy. A graduate of the University of Illinois, he has served on the A.F.S. Staff for 12 years, from 1929 to 1933, and from February, 1942 to date.


BUFFALO ...
55th convention city
April 23-26, 1951

REPORT to the MEMBERSHIP 1949-50

The "Stockholders" of the American Foundrymen's Society are the Members. This, then, is the nature of a "Stockholders' Report." It is *your* Society; you should know what it is doing and plans to do.

The strength of the Society lies in the fact that each membership is held in the name of an *individual*. Every member has equal opportunity to participate in its activities, to approve what is being done—and to exercise his member right of complaint.

What the Society produces is available to all, and your A.F.S. today is recognized as one of the major professional technical societies of the world. You, the members, made it so . . . only the members, by their interest and activity, can keep A.F.S. in the front ranks.

LEADERSHIP

Progress of the Society may be credited almost entirely to the caliber of men who give their time, effort and knowledge to help others. During 1949-50, A.F.S. was fortunate to have as its National leaders: President E. W. Horlebein, president of Gibson & Kirk Co., Baltimore, Md.; Vice-President Walton L. Woody, vice-president of operations, National Malleable & Steel Castings Co., Cleveland.

The Society sadly records the loss of three valued Directors through death: H. G. Lamker of Peterboro, N. J.; J. E. Kolb of Peoria, Ill.; and A. M. Fulton, St. Paul, Minn. The terms of Messrs. Lamker and Kolb were due to expire July, 1949. The vacancy (to July, 1951) created by Mr. Fulton's death was filled by appointment of Martin J. O'Brien, Jr., Depew, N. Y.

RECOGNITION

Awards of A.F.S., as the technical society of the Foundry Industry, are recognized everywhere as top goals of achievement. During 1949-50, five men received these coveted A.F.S. honors (see AMERICAN FOUNDRYMAN, April, 1950, page 60).

CONVENTION

Returning to Cleveland for the eighth time, A.F.S. staged an outstanding 54th Annual Convention May 8-12. Sessions were exceptionally well attended, British and French exchange papers presented, and a great fund of useful data delivered. Several Divisions pooled their knowledge in excellent joint sessions, six Divisions held round-table meetings, and three offered practical shop courses. A session on Management Functions & Controls, presented this year for the first time, was well received.

Attendance totaled approximately 12,000, including local plant admissions on Northeastern Ohio Day. Cleveland foundries reported gratifying numbers visited them on plant inspections.

EXHIBITION

Universal satisfaction was expressed over the quality of exhibits and new materials and equipment shown, at the 1950 Foundry Show, staged by A.F.S. The event drew visitors from some 18 foreign countries, including British and Norwegian productivity teams attending under ECA auspices. Many new and improved items of equipment were displayed and operated, as reported in the February, March, April, and May issues of AMERICAN FOUNDRYMAN.

Registration fees charged this year (Members $3, non-members $7) were as recommended by a Committee of Exhibitors and approved by the A.F.S. Board. The result was a highly selective audience of foundrymen interested in both the technical meetings and the exhibits. All Company and Sustaining members were allowed to pre-register their employees at the member rate. Non-members were permitted to apply $4.00 of their registration fees against membership dues.

"AMERICAN FOUNDRYMAN"

During the past year the A.F.S. Board, recognizing the steadily growing importance of AMERICAN FOUNDRYMAN, took steps for its further advancement. Numerous features were widely accepted: Modern Foundry Methods, Questions and Answers, Letters to the Editor, and Exhibits Preview, Classified Advertising and Employment Service. The magazine now is receiving unsolicited papers from all over the world and a high degree of selectivity has been achieved.

Advertising representatives in New York, Cleveland and Chicago have now been appointed in view of the magazine's broader acceptance. While still the official organ of A.F.S., AMERICAN FOUNDRYMAN must meet, and is meeting, all standards of long-established com-

mercial magazines. It is a valuable phase of A.F.S. Service to Members, and the number of non-member subscribers is constantly growing.

CHAPTERS

No new organizations were added to the list of 40 regular Chapters since formation of the Mo-Kan Chapter at Kansas City, Mo., in March, 1949. However, two new Student Chapters were approved by the Board: No. 8—Michigan State College, East Lansing, Mich., installed April, 1950; No. 9—University of Alabama, University, Ala., approved April, 1950.

A comprehensive Chapter Manual was completed and distributed to all Chapters in December, 1949, and all Chapter boundary lines were reviewed, revised and approved for the first time since 1934. The 6th Annual Chapter Officers Conference was held late in June, 1949 with 82 Chapter Officers attending, 78 at A.F.S. expense. These annual events have materially improved Chapter operations and enthusiasm, and have made the local groups more conscious of their importance in and obligations to A.F.S. as a whole.

A selected Speakers List was revised for Chapter use, and a large Film List completely reissued, both intended to maintain the caliber of Chapter programs. The A.F.S. film *"Fluid Flow in Transparent Molds,"* developed by the Aluminum & Magnesium Division, was shown at many Chapters and in many foundry organizations.

All in all the A.F.S. Chapters held well over 300 local meetings for improving knowledge of foundry work, and seven Regional Foundry Conferences were sponsored by one or more Chapters. Additional "regionals" are being organized for 1950-51. Several Chapters also arranged Educational Courses for their members on foundry fundamentals.

COMMITTEES

The backbone of A.F.S. technical activity lies in the Society's eight Divisions (Gray Iron, Malleable, Steel, Brass & Bronze, Aluminum & Magnesium, Patternmaking, Sand, Education) and additional General Interest Committees (e.g., Refractories, Plant & Plant Equipment, etc.). Any member may volunteer for committee service, agreeing to attend meetings and contribute of his knowledge. Expenses of members attending meetings are reimbursed when expense accounts are submitted to the National Office.

Faithful service, willingness to help others while learning, and constant interest in the Society have made A.F.S. Committee work outstanding. The membership owes a debt of gratitude to every A.F.S. Committee member.

Committee and Divisional activities of the Society are reviewed (in June) by a Technical Correlations Committee. The purpose of this body is to avoid overlapping functions and duplication of effort, to coordinate all technical activities, and to recommend to the Board such action as may be necessary for the technical groups best to perform their work.

RESEARCH

Each Division of A.F.S. may sponsor, subject to Board approval, research on fundamental problems to a maximum annual expenditure of $5000. Definitive contracts cover all projects, and the Divisions may pool their efforts and allowable funds. As a result of this plan, adopted in 1946, the following Divisional research projects were carried on during 1949-50:

Aluminum & Magnesium—*"Hydraulics of Light Metal Flow into Molds"*—at Battelle Memorial Institute, Columbus, Ohio.

Aluminum & Magnesium—*"Centrifugal Casting of Light Metal Alloys"*—at Canadian Bureau of Mines.

Brass & Bronze—*"Fracture Test as an Index of Melt Quality"*—at University of Michigan.

Gray Iron—*"Gating and Risering of Gray Iron"*—Massachusetts Institute of Technology.

Heat Transfer Committee—*"Fundamentals of Heat Flow During Solidification"*—at Columbia University.

Malleable Iron—(1st project completed, 2nd under consideration.)

Sand—*"High Temperature Properties of Molding Sands"*—at Cornell University.

Steel—*"Relation of Cores to Hot Tearing"*—Armour Research Foundation.

In addition, A.F.S. has carried on for some years valuable work in Cupola Research. Present project covers *"Influence of Heredity on Coke Behavior in the Cupola,"* with the cooperation of the U. S. and Canadian Bureau of Mines, Ford Motor Co., and Eaton Mfg. Co. Recent material shortages affected advancement of this work, for which a full-time research worker is employed. Funds for Cupola Research were contributed in 1940-1943 by iron foundries and others interested in this work.

EDUCATION

Educational activities of A.F.S. in 1949-50 consisted of: encouraging and assisting the work of Chapter Educational Committees; conducting the annual National Apprentice Contests; preparing and publishing training information; forming and aiding Student Chapters; consulting and advising numerous school

Typical view of the exhibit halls at an A.F.S. Foundry Congress and Show, where foundrymen from all over

authorities; and cooperating with the Foundry Educational Foundation.

A.F.S. is a charter sponsor of FEF, but administers neither the funds nor the program of the Foundation, whose headquarters are in Cleveland. Educational matters at the college level have been delegated to the Foundation, A.F.S. largely confining itself to secondary schools.

Five National Apprentice Contests were conducted in 1949-50, metal patternmaking being a new contest, and the five first prize winners were brought to the Cleveland Convention to receive their awards in person. A number of Chapters and private firms participated in the Contests.

MEMBERSHIP

A combination of circumstances—lessened foundry production, increased dues, and drastic currency devaluations abroad—resulted in an 8.8 per cent loss in Membership from July 1, 1949 (10,063 members) to May 31, 1950 (9168 members). This loss is already being made up as castings production has increased and as plant improvements have been stimulated by the recent Foundry Congress in Cleveland. Between July 1, 1949 and May 1, 1950 a total of 1650 new members was recorded, 2545 members dropped for all causes, a net loss of 895 members for 11 months.

CODES

The codes of recommended safe practice, developed by the A.F.S. Safety & Hygiene Committee some 12 years ago, pointed the way for today's attention to clean, healthful and safe foundry plant conditions. The A.F.S. Board, acting on recommendations of a representative group of foundrymen, in January, 1950, approved initiation of a strong Safety & Hygiene program, with a full-time Staff coordinator. It is estimated that the program will require some $35,000 a year for a minimum 10-year period to develop additional badly needed codes of recommended practice on such subjects as air pollution, cupola dust control, electric melting furnace and nonferrous melting fumes, etc. Necessary funds not being available from the Society's current operating revenues, support of the industry will be sought this fall.

the world meet to exchange ideas and see the latest tools and materials of the foundry craft on display.

PUBLICATIONS

New publications issued during 1949-50, prepared by A.F.S. technical committees, include:

Foundry Core Practice—2d edn., Feb. 1950.
Transactions, Vol. 57 (1949)—Dec. 1949.
Apprentice Training Outline—Dec. 1949.
Guide for Foreman Training Conferences—Jan. 1950.
College Research Projects—Feb. 1950.
Gating & Risering Gray Iron Castings—May 1950.

Publications in course of preparation and nearing completion include:

Metallography of Cast Metals (2d edn.)
College Foundry Text Book.
High School Foundry Text Book.
Sand Testing Handbook (6th edn.).

A.F.S. publication and pricing policies are established and reviewed annually by a Publications Committee, appointed by the Board. As soon as a book is published, its future revision and improvement are at once contemplated.

FINANCE

The wide range of A.F.S. activities and breadth of operations have induced close Board attention to finances. Today, in any 2-year period, Society expense averages about $450,000 annually, income slightly larger. Actions taken by the Board during the past two years to augment sources of income have been intended mainly to provide funds for needed activities, secondarily to create reserves deemed adequate for an operation of the present extent.

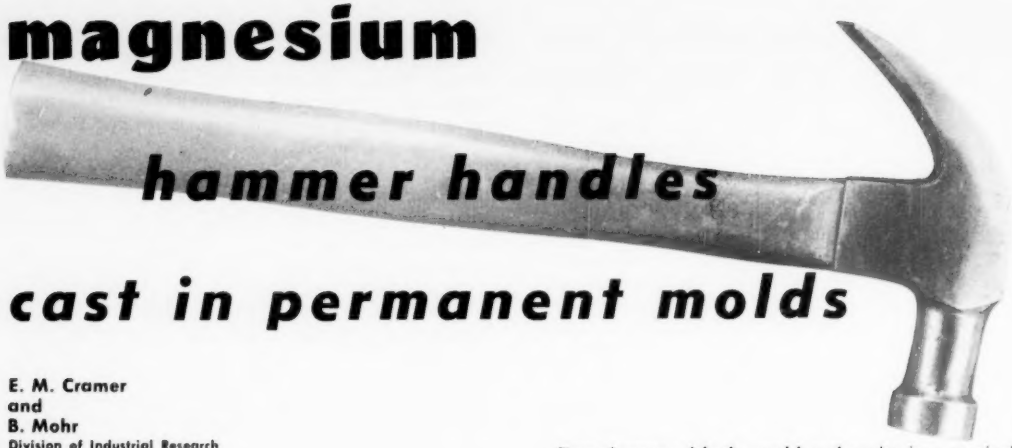
Accounting methods of the Society were studied and completely revised during 1949-50, in accordance with generally accepted accounting practice. A.F.S. budgets, finances and investments are under control of a Finance Committee of the Board. Books are audited annually by certified public accountants, and annual statments published in Transactions.

MANAGEMENT

Top management of many foundries can no longer maintain personal activity in A.F.S. affairs, due to other interests. It is vitally to the *interest* of Management, however, to *encourage* employees to be active in A.F.S., to encourage membership, and to *insist* that the men utilize every means of learning more about castings production. Certain things Management can do: Address civic groups on foundry problems and subjects; Stress constantly the inherent advantages of all cast metals; Contact school and college administrators and express interest in training for foundry work; Make A.F.S. literature available to all employees and encourage them to participate in A.F.S. work.

Technically submitted,
AMERICAN FOUNDRYMEN'S SOCIETY

magnesium hammer handles cast in permanent molds



E. M. Cramer
and
B. Mohr
Division of Industrial Research
State College of Washington
Pullman, Wash.

AS PART OF A BROAD PROGRAM of study of the applications of light metals, an investigation was made of the feasibility of casting magnesium hammer handles by the permanent mold process. The report of the investigation (Division of Industrial Research Bulletin No. 205) includes recommendations on a method of casting, comparison of the strength of hickory and magnesium handles, and the yield obtained in terms of metal poured.

Although the magnesium handles have not been produced commercially, several were mounted and used successfully in the laboratories. One hammer was used by several carpenters in spiking 2x8 in. surfaced planking, flat on flat, in constructing a grain elevator. This service entailed extremely heavy and consistent nailing, but without exception the carpenters had high praise for the magnesium handle, reporting no shock effects to hands or arms.

The requirement that the metal handle have approximately the same weight as a hickory handle of equal size presented an unusual problem in casting and necessitated that the handle be hollow with a minimum wall thickness of about ⅛ in. This type of magnesium casting requires close control of metal, mold, and core temperatures.

Making the Mold

The experimental mold, with book-type opening and positive latch, was machined from gray cast iron. Ejector pins and lever operating mechanism were attached to the mold. Preheating was provided by external gas burners made from 1-in. pipe and attached to the mold base just below the mold itself.

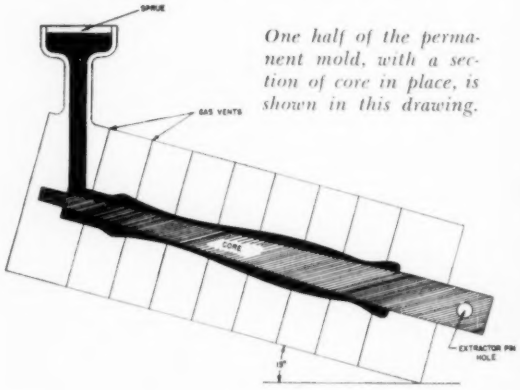
Various gating systems were investigated by machining new runners and gates in the mold as required and blocking off previous systems by brazing in steel patches. In the first experiment, metal was introduced through a horn gate and entered at the bottom of the mold cavity, which was inclined about 30 degrees above the horizontal. The castings obtained by this system were sound in outward appearance but showed microshrinkage, and the operating range of metal and mold temperatures was very narrow.

Experiments with the mold and cavity in a vertical position with a long sprue to the bottom of the mold resulted in excessive inclusions and an increased tendency toward misruns. Further experiments showed that successful castings could be poured by inclining the mold cavity about 15 degrees downward from the gate, which introduced the metal directly into the top of the mold cavity. In this position, the sprue and gate took the form of an open riser connected directly with the heavy section of the casting at the point of attachment of the hammer head, as shown by the drawing.

A mold coating is necessary in order to insure proper solidification of the casting. A commercial coating was found satisfactory; also, a preparation made in the proportions of 3 gal of water, 1½ pints of 40 per cent sodium silicate, 1 lb of precipitated chalk or whiting, and 1½ oz of graphite or rouge was employed satisfactorily[1]. These ingredients are prepared by adding the sodium silicate to boiling water, boiling for 2 min and then stirring in the whiting and graphite or rouge. The preparation should be cooled before using and stored in a closed container.

Preparation of Mold and Core

In preparing the mold for operation or for replacing the mold coating, the cavity should be cleaned thoroughly with a wire brush, steel wool, or light sand blasting. The mold should be heated to 375-400 F, and



One half of the permanent mold, with a section of core in place, is shown in this drawing.

the coating applied with a blow pot or paint spray gun. A progressively thinner coating from the gate to the lower part of the mold cavity must be achieved; if too much is applied, the thickness should be reduced with steel wool.

A coating 0.002-0.004 in. thick should be maintained since it acts as an insulator of heat and aids in establishing progressive metal solidification from the lower end of the mold cavity toward the gate. The coating need not be replaced until it flakes off or is destroyed. After coating, the mold should be heated to 700 F and allowed to cool to the operating temperature, 640-675 F, before pouring to allow the heat applied by the gas burners to become evenly distributed.

The core is cleaned by wire brush or steel wool because sand blasting leaves a rough surface that will interfere with drawing. It should then be heated to 375-400 F and sprayed with a uniform coating about 0.004 in. thick, and preferably containing graphite. Because of the long draw, the core coating is of relatively short life and must be replaced frequently. After coating, the core may be heated to its operating range temperature, 730-740 F.

Preparing the Metal

The melting of magnesium alloys should be undertaken only with adequate safety precautions[2,3]. It is recommended that the magnesium alloy be melted in cast- or welded-steel crucibles under a cover of No. 230 flux. Refining is carried out with the same flux, as is the protection of the metal during dipping and pouring. The pouring ladle should be kept wet with flux (a separate flux pot held at metal temperature serves this purpose) to prevent undue agitation of the melt and the introduction of excessive oxides into the metal.

Since the flux is very fluid, the ladle is introduced into the metal with a swirling motion which sweeps clean a spot on the surface from which the ladle is filled. After pouring, the flux cover should be replaced by lightly dusting additional flux on the exposed surface to prevent burning. Excess flux and oxides accumulate in the bottom of the melt and must be sludged from the crucible periodically. A satisfactory metal temperature is 1160-1200 F.

With the metal, mold, and core at operating temperatures, the sequence of operation is:

Close mold, insert core, and attach extractor bar.

Dip ladle of metal from crucible and pour casting.

Replace ladle in crucible or flux pot and dust No. 230 flux on metal.

Extract core and replace in heater.

Open mold and eject casting carefully since it is very fragile at this stage.

The time required for this operation is 3 to 5 min, depending on the mechanisms used for temperature control, extracting the core, opening the mold, ejecting the casting, and the skill of the operator. Extraction of the core is critical inasmuch as the long draw makes the process difficult after appreciable cooling has taken place. If cooling has progressed too far, the casting will be cracked or pulled apart when the core is withdrawn.

Tests conducted to gain a comparison of the strength of the magnesium handle and an orthodox hickory handle consisted of holding the hammer end of the handle in a fixture and statically loading the other end with weights. The testing fixture was designed to simulate the eye of a hammer head. For nine magnesium handles the loads at failure ranged from 535 to 670 lb, averaging 573 lb. Five hickory handle specimens had a load failure range from 120 to 160 lb, with an average of 140 lb.

The weight of the magnesium handle was 6.5 oz, and the weight of metal poured was 12.5 oz. In terms of metal poured, the yield is 52 per cent.

Conclusion

The results of this investigation show that it is possible to cast magnesium hammer handles in a permanent mold on a production basis. The handles

The magnesium handle is fitted to the eye of the hammer by filing, and wedged with aluminum wedges. No loosening of the handle in the eye has been noted.

produced experimentally were satisfactory in appearance and performance.

The following recommendations concerning the casting procedure are made:

1. The permanent mold may be electrically heated by units imbedded in the mold and automatically controlled by a potentiometer controller.

2. The core can best be maintained at the proper temperature by means of an electrically heated and automatically controlled lead or suitable salt bath.

3. The metal should be held in an automatically controlled electric tilting furnace filled from a separate melt-down furnace.

The hammer handle presents a possibility of production by die-casting methods and a consequent shortening of the time involved per handle. However, no investigation of this possibility has been carried out.

References

1. Alfred Sugar, *Die Casting and Permanent Mold Casting*, The American Metal Co., Ltd., New York, 1944.

2. Permanent Mold Practice for Magnesium Alloys, Bulletin No. DM101, The Dow Chemical Co., Midland, Mich.

3. Schonfeld and Leonard, "The Operation of a Small Magnesium Foundry," Bulletin No. 202, Washington State Institute of Technology, Pullman, Wash.

Publish Registered Attendance List

As a service to exhibitors in the 1950 A.F.S. Foundry Congress and Show a Registered Attendance List of registrants at this year's Show will be published. Distributed to exhibitors gratis the list is arranged geographically and gives company name and address, and title of men listed. Included are representatives from all over the United States, the District of Columbia, the Canadian provinces, Mexico, and over 15 countries outside of North America.

Shown in the photograph at left above are members of a Norwegian Foundry Productivity Group, and in photograph at right a British Brass Foundry Productivity Team, both under ECA sponsorship, who attended the 54th A.F.S. Foundry Congress & Show in Cleveland in the course of a nationwide tour of foundries.

FOUNDRYMEN FROM MANY LANDS ATTEND 54th A.F.S. CONVENTION

Representing 18 nations, ranging from far-off Australia and India to nearby Cuba, were some 96 prominent foundrymen attending the 1950 A.F.S. Foundry Congress & Show, May 8-12 in Cleveland. This number was exclusive of large delegations from the three A.F.S. Canadian and the Mexico City Chapters.

Included among notable foreign visitors were the heads of British, Norwegian, and Swedish foundry organizations and members of Norwegian and British foundry productivity teams touring U. S. foundries.

This year's attendance is indicative of advance interest in the 1952 International Foundry Congress, when A.F.S. will be host as foundrymen from all over the world meet to advance their craft through exchange of knowledge.

Three nations are represented in this group of overseas foundrymen. Left to right: Ake Johnson, A.B. Johnson-Werken, Orebro, Sweden; Jan Roorda of Stork Engine Works, Hengelo, The Netherlands; Thomas Lewander, Hugo Montgomery A.B., Stockholm, Sweden; William A. Gibson, Gibson Eng. Pty., Ltd., Sydney, Australia; and Sven Torreson, A.B. Totaverken, Swedish Foundrymen's Association official.

AUSTRALIA

Sydney

GIBSON ENG. (SALES) PTY., LTD. William A. Gibson

BELGIUM

Liege

COMPANIE GENERAL DES CONDUITES D'EAU. Robert Doat

Merksem

SOCIETE BELGE GRIFFIN. Jacques De Vus

CUBA

Havana

LAMPARAS QUESADA INDUSTRIAL SA. Francisco V. Alsina; Ildefonso Quesada, Jr.

DENMARK

Glostrup

PAUL BERGSOE & SON. Henry V. Hermansen

Veile

C. M. HESS FABRIKKER. Kaj Larsen; Arthur Nilsson

ENGLAND

Birmingham

SAMUEL BOOTH & SONS LTD. William F. Underhill

HARRISON (BIRMINGHAM) LTD. George B. Booth; Bryce G. Dewsbury

PEARSON, PAGE JEWSBURY CO. John P. Jewsbury

PHOSPHOR BRONZE CO., LTD. Edward McVicar Anderson; Albert N. Wormleighton

WHITEHOUSE BROS. John J. Keight

W. & T. AVERY LTD., SOHO FOUNDRY. A. J. Shore, Fdy., Mgr.

Chippenham

WESTINGHOUSE BRAKE & SIGNAL CO. Donald H. Potts

Kent

BRITISH MOULDING MACHINE CO., LTD. H. J. Bullock; V. L. Cashmore

London

COUNCIL OF IRONFOUNDRY ASSOCIATIONS. Kenneth Marshall

INTERNATIONAL COMBUSTION LTD. G. R. Taylor

MOND NICKEL CO., LTD. Frank Hudson

NON-FERROUS METALS RESEARCH ASSOCIATION. Edward Charles Mantle

Manchester

DOVER ENGINEERING WORKS. M. T. Glenny

INSTITUTE OF BRITISH FOUNDRYMEN. N. P. Newman

TILGHMAN'S PATENT-SAND BLAST CO., LTD. B. C. Tilghman

Oxfordshire
ALUMINUM LABORATORIES LTD. Robert T. Parker
Rochdale
JOHN HOLROYD & CO., LTD. Henry Frost; R. Woods
Rotherham
GUMMERS LTD. Leonard W. Gummer
Sheffield
CLIMAX MOLYBDENUM CO. OF EUROPE LTD. M. E. T. Gill; Brinley Jones
Smethwich
EVERED & CO., LTD. Frank E. Rattlidge; Charles H. Wilson
Staffordshire
BILLINGTON & NEWTON, LTD. Cyril A. Timms, Fdy. Mgr. & Met.
LLOYD'S (BURTON) LTD. W. R. Cooper, Plant Met.; Norman Croft, Plant Met.
Wolverhampton
E. P. JENKS, LTD. Reginald T. Bunch

FINLAND

Karhula
KARHULA MACHINE WORKS & STEEL FOUNDRY. Eikki Kreula.

FRANCE

Nancy
FONDERIE DE PONT A MUSSON. Students Henry de Bouviet; Maurice Grandpierre; Engineer E. Guenzi
Paris
FOUNDRY SERVICES LTD. Roland L. Lucien, Mgr.
SOCIETE ANONYME DES MACHINES OSBORN. Alexandre Triquet
USINES ET ACIERIES DE SAMBRE-ET-MEUSE. Pierre J. Boissier
Seine
BONVILLIAN ET RONCERAY. Robert Ronceray, Pres.
Toulouse
S. A. AMOUROUX FRERES. George Amouroux

GERMANY

British Zone
GOETZEWERKE. W. A. Geisler
Frankfort
DIPLOM INGENIEUR. Reinhold Crummenauer
Remscheid
ALEXANDERWORKS. Max Benscheid
Rendsburg
AHLMANN CARLSHUTTE K. G. Hans F. Schlothfeldt, Fdy. Eng.
Wetzlar
BRUDERUS'SCHE EISENWERKE. Franz Grosser.

HOLLAND

Hengelo
STORK ENGINE WORKS. Jan Roorda

HUNGARY

Budapest
ENGINEER. George Srego

Prominent foundrymen from overseas, shown with President Horlebein (third from left) at the International Reception, May 9, included, starting left, Robert Ronceray of France, son of an A.F.S. Gold Medalist; Noel P. Newman, president of the Institute of British Foundrymen; and John L. Sissener, president of the Norwegian Foundrymen's Technical Society.

Of the several Swiss present at the 54th A.F.S. Foundry Congress & Show were, left to right: Swiss-born John H. Romann, now vice-president, U. S. Engineering & Mfg. Co., Chicago; J. P. Honnegger, Sulzer Bros., Ltd., Winterthur; Walter Goetz and Erwin Buhver, both of George Fischer, Ltd., at Schaffhausen, Switzerland.

Fellow North Americans attending the 54th Foundry Congress & Show were (left photo) those of the A.F.S. Mexico City Chapter, left to right: Eugenio D. Aleman, Metallurgica Almena, Mixcoac, Mexico; Delbert Luper, Iturbe y Zalce, Tucubaya, Mexico; A.F.S. National Secretary-Treasurer Wm. W. Maloney; Mexican Consul B. Rios-Franco, Cleveland; and Juan Collignon, Sr., and Juan Collignon, Jr., Cia. Mfra de Artofactos, Guadalajara, Mexico. In photograph at right are prominent representatives of A.F.S. Canadian Chapters, left to right: A.F.S. Honorary Life Member Harold J. Roast, consultant, Westmount, Que.; Past National President L. L. Anthes, Anthes Imperial, Ltd., Toronto; Past National Director Joseph Sully, retired foundryman of Toronto, Ont.; and A.F.S. National Director E. N. Delahunt of Warden King, Ltd., Montreal.

Shown viewing an exhibit of German and Swedish gray iron art castings, displayed through the courtesy of George W. Cannon and Henry J. Trenkamp are, left to right: Rolf Landmark, attached to Norwegian Attache, Washington, D. C.; Thomas Lewander of Sweden; Dr. Reinhold Crummenauer of Germany; A.F.S. President E. W. Horlebein; Eugene Sinner of Switzerland; George W. Cannon; and Dr. Franz Grosser, German foundryman, who made most of the castings.

INDIA

Bombay

Killian Steel Ball Corp., Hartford, Conn. Harsukh Mehta
Student, U. of Mich. Yeshwant P. Telong

ISRAEL

Haifa

Vulcan Foundries. S. Shrira; Israel Yoshpe
Mechanical Engineer. Imre Adler

Tel-Aviv

Hamalchim Ltd. Dov Bufman; Ad Rosner

ITALY

Rome

Finmeccanica. A. G. Van Wye

MEXICO

Aire Libre Pus

Texuitlan Copper Co. Urbano Lopez Ayala

Guadalajara

Cia Mfra. de Artefactos Metaticos SA. Juan L. Collignon; Juan L. Collignon, Jr.

Mexico City

Metalugica Almena. Eugene D. Aleman

Monterrey

T. Carlos Leon & Sons. T. Carlos Leon Jr.

Tacubaya

Iturbe y Zalce. Delbert G. Luper

NORWAY

Frerikstad

A/S Fredriksstad Mek. Verksted. Thorleif Otto Jahren; Birger Marthinsen

Hamar

A/S Hamar Jernstpori & Mek. Verksted. Gunnar Myhrvold

Jaeren

Serigstad Maskinverksted. Torkel Serigstad

Oslo

Foss Jernstperi. Karl Stenstadvold
Jotul og Kvaerner Ovnstoperi A/S. Einar Johnsen; Ragnar Hilmar Olsen; Knut Tronstad
Myrens Verksted A/S. Harry Thorleif Karlberg; Ivar Edward Larsen
Norwegian Embassy & E.C.A. Rolf Landmark
Norwegian Foundryman's Technical Society. John Larsen Sissener
Statens Teknologiske Institutt. Torolf E. Krogvig

Raufoss

Raufoss Ammunisjonsfabrikker. Oddleiv Kristiansen

Sandnes

A/S Sandnes Stperi. Ragnar Astad; Tnnes Tollefsen

Strommen

A/S Strommens Vaerksted. Ragnar Brynildsbakken

SCOTLAND

Airdrie

The Grit Company of Scotland Ltd. James Meldrum

Paisley

Paisley Brass Works. Nelson Maxwell

SWEDEN

Goteborg

A. B. Totaverken. Sven Toresson, Fdy. Mgr.

Malmo

A. B. Limhamns Aduceringsverk. Sten Linander

Orebro

A. B. Johnson-Werken. Ake Johnson, Pres.

Stockholm

Hugo Montgomery A. B. Thomas Lewander, Vice-Pres.

SWITZERLAND

Bern

H. G. Faucherre, Swiss rep.

Schaffhausen

George Fischer, Ltd. Erwin Buhrer; Walter Goetz; P. F. Homberger

Uzwil

Buhler Bros. Adolf Buhler; A. M. Keller

Winterthur

J. J. Rieter. Eugene Sinner, Fdv. Mgr.
Sulzer Bros., Ltd. Paul Honegger
H. Theiler Foundry Service. H. E. Theiler

Zurich

MR Rutl. Iwan Fasnacht, Direktor

TURKEY

Istanbul

Ali Riga Agricultural Implements Factory. Ferit Samikoglu

Shown with A.F.S. Secretary Emeritus Robert E. Kennedy (third from left) at the International Reception during the 54th A.F.S. Foundry Congress are; left to right: Robert Doat, Companie General des Conduites d'Eau, Liege, Belgium; Henry Hermansen, Paul Bergsoe & Son, Glostrup, Denmark; and Torolf E. Krogvig, of Statens Teknologiske Institutt of Oslo, Norway.

MAGNESIUM DETERMINATIONS IN NODULAR CAST IRON—SAMPLING AND ANALYSIS METHODS

J. L. Yarne, Metallurgist
and
W. B. Sobers, Chemist
Chain Belt Co.
Milwaukee

IT APPEARS THAT MUCH WORK MUST BE DONE before nodular iron is established on a sound engineering basis. Past work indicates that it may be necessary to control closely the amount of residual magnesium for different types of base iron.

A lack of precise chemical and foundry control may result in an inferior product. Improper chemical composition may result in undesirable structures such as free carbides and flake graphite, depending on section size. The control necessary to produce good nodular iron will require more precision than that normally used in the average gray iron foundry.

For these reasons and for future development work, a rapid and accurate wet method for the determination of magnesium is essential for the average metallurgical laboratory which does not have spectrographic equipment. We have found the following wet method to meet these requirements:

1. Phosphorus separated by dissolving sample in HCl.
2. Silicon and graphite separated by filtering.
3. Bulk of iron extracted with ether.
4. Remaining iron and manganese separated with ammonium hydroxide and ammonium persulphate.
5. Copper, nickel and other sulphides separated with H_2S.
6. The Mg is finally precipitated as magnesium quinolate, Mg (C_9H_6NO) 2, which contains 6.98 per cent Mg; or it may be finished as magnesium pyrophosphate, $Mg_2P_2O_7$.

This method is discussed in detail as follows: place duplicate samples weighing 2 grams each in separate 400 ml beakers and add 50 ml hydrochloric acid (1-1). Cover beaker with watch glass. When solution is complete, add 15 ml of perchloric, nitric acid solution to oxidize the iron; no special precautions are necessary to prevent the solution from frothing over as a result of this oxidizing reaction.

Cover beaker with watch glass and boil to speed evaporation to dryness (do not bake). Add 10 ml of hydrochloric acid (conc.) and 20 ml of water, bring solution to boil or digest at hot heat until the soluble salts are in solution. While the solution is still hot, filter through a single sheet of double-acid-washed 11-cm filter paper, catching the filtrate in a 250-ml beaker.

Add 15 ml of HCl (1-1) to a small graduate and transfer this solution to the 400-ml beaker, at the same time washing down the sides of the beaker. Heat short of boiling and use this hot solution to wash down the filter paper while revolving the funnel slowly with one hand on the funnel stem. Repeat this washing operation using 15 ml of hot HCl (1-1). Follow these two washings with two 10 to 15 ml washings of hot HCl (1-1) from a washing bottle, and one 15 ml wash of hot water.

Cool the 250-ml beaker in a cold water or ice bath. For each 2-gram sample add 10 ml of HCl (conc.) and 80 ml of ether to a 150-ml beaker, mix, cover with watch glass and cool. The cold iron chloride solution is transferred to a separatory funnel, and the 250-ml beaker flushed out with one of the 80-ml solutions of cold ether, acid mix and transferred to the separatory funnel.

Shake gently for a minute or two and occasionally release the pressure. Let stand for 5 min and draw off the acid layer of each 2-gram sample into the same 400-ml beaker. (The duplicate 2-gram samples are combined at this point to make one 4-gram sample. Initially, a 2-gram sample is used in order to get a good separation of the free carbon, silicic acid and bulk of iron.) Discard the ether-iron solution in the separatory funnel, and boil the solution in the beaker to expel the dissolved ether.

Several Washings Necessary

Dilute with distilled water to approximately 200 ml and make slightly ammonical to precipitate the remaining iron and any other elements that are precipitated as a hydroxide. Add 10 ml of ammonium persulphate solution (10 per cent) to precipitate the manganese. Heat to boiling, and boil one minute. Allow precipitate to settle and filter the hot solution into a 600-ml beaker. Wash the residue several times with hot ammonia water (1 per cent).

Discard the precipitate. Heat the solution to boiling and gas rapidly while hot for 5 or 10 min with hydrogen sulphide. Let precipitate settle and filter, catching the filtrate in a 600-ml beaker, wash sulphide residue 3 or 4 times with ammonia water (1 per cent) saturated with H_2S. Boil to reduce the volume to 150 ml and expel the H_2S. Filter into a 400-ml beaker, washing any residue with ammonia water (1 per cent). Discard paper which may contain any residue or small amounts of sulphides. Finish for magnesium by one of the following methods.

Method A: Add 10 ml of ammonium hydroxide (conc.) to the filtrate and adjust the temperature to approximately 100 F. Add dropwise 10 ml 8-hydroxyquinoline solution while stirring the solution. Continue stirring for 5 or 10 min, or until precipitation is complete. Allow precipitate to settle 15 min or longer and filter on a tared fritted glass crucible of medium porosity.

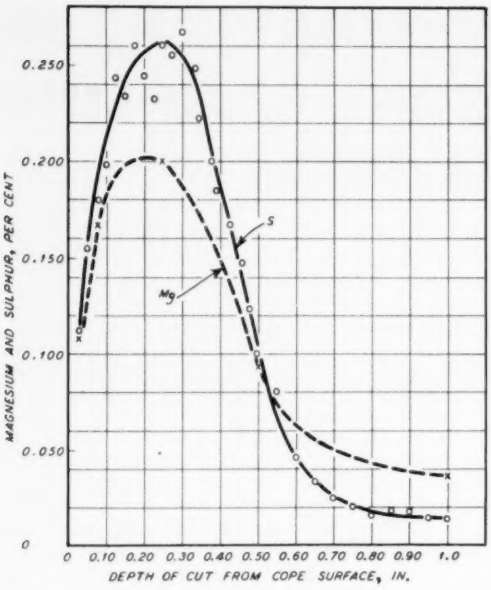


Fig. 1—Segregation of magnesium and sulphur occurring in cope section of a 4x4x8-in. block of nodular iron.

TABLE 1—CHEMICAL ANALYSIS, MAGNESIUM TREATED IRON

T.C.	Si	Mn	S*	P
3.40	2.01	0.50	0.074	0.205

*Initial sulphur, 0.130 per cent.

Drag Face — 4x4x8-In. Test Block

Depth, in.	Si	Mn	S	P	Cu	Mg
0.025	3.09	0.45	0.027	0.205	0.58	0.038
0.050	3.07	0.48	0.041	0.240	0.55	0.039
0.075	3.07	0.48	0.041	0.230	0.51	0.039

Cope Face — 4x4x8-In. Block

0.025	3.10	0.48	0.112	0.240	0.53	0.108
0.050	3.14	0.48	0.155	0.245	0.51	0.133
0.075	3.32	0.48	0.180	0.230	0.51	0.168
0.100			0.195			
0.125			0.243			
0.150			0.234			
0.175			0.260			
0.200			0.255			
0.225			0.233			
0.250		0.48	0.261			0.200
0.275		0.49	0.255			
0.300		0.49	0.267			
0.325		0.50	0.249			
0.350		0.50	0.222			
0.375			0.200			
0.400			0.185			
0.425			0.168			
0.450			0.147			
0.475			0.124			
0.500			0.100			0.093
0.550			0.080			
0.600			0.046			
0.650			0.035			
0.700			0.025			
0.750			0.021			
0.800			0.017			
0.850			0.018			
0.900			0.018			
0.950			0.015			
1.00*	3.11	0.50	0.015	0.205	0.53	0.037

* Total Carbon, 3.30

Wash residue with hot ammonia water (1 per cent), dry for one hour at 110 C, and weigh as magnesium quinolate.

$$\frac{Mg(C_9H_6NO)_2 \times 6.98}{\text{Wt. of Sample}} = \% \text{ Mg}$$

Method B: Acidify the solution with hydrochloric acid and cool. Add 10 ml of sodium ammonium phosphate (10 per cent). While stirring the solution, add 20 ml of ammonia (conc.) and continue stirring until the magnesium precipitates. Let stand for several hours, or preferably over night.

Filter on a tared gooch crucible having an asbestos mat which has been previously ignited at a hot heat, or filter through a 7 cm filter paper. Wash the residue with very dilute ammonia water, char the paper, and finally ignite to constant weight at a high heat (1000 C) and weigh as $Mg_2P_2O_7$.

$$\frac{Mg_2P_2O_7 \times 21.84}{\text{Wt. of Sample}} = \% \text{ Mg}$$

If calcium is expected, the solution may be checked for calcium before the precipitation of the magnesium as follows: to the slightly ammonical solution add 5 ml of ammonium oxalate solution (saturated). Bring to boil and allow to set for several minutes. Filter off the calcium (if any) and wash with a dilute ammonium oxalate solution. The filtrate is treated by method (A) or (B) as outlined.

Solutions: Perchloric, Nitric Acid. 250 ml H_2O; 250 ml HNO_3; 1000 ml $HClO_4$.

8-hydroxyquinoline. 2.5 grams 8-hydroxyquinoline; 5 ml acetic acid. Heat the acetic acid to dissolve the 8-hydroxyquinoline and add 95 ml water.

Correct sampling of ferrous material for chemical and spectrochemical analysis is very important. To take or prepare a uniform representative sample requires skill and judgment which often is not recognized. This is particularly true when elements are present that do not go in solid solution within the iron. Cases often occur where segregation of such elements is of such magnitude that improper sampling may give a misleading picture of the true overall conditions.

To acquire more information concerning the variation that may occur in nodular iron, particularly with reference to the magnesium and sulphur, tests were conducted on a cupola base iron treated with magnesium. One ton of ordinary gray iron was desulphur-

TABLE 2—CHEMICAL ANALYSIS, MAGNESIUM TREATED IRON

Test No. 1 — ⅜ x 1¼ x 6-In. — Hot Metal

Si	Mn	S	P	Cu	Mg
4.00	0.48	0.014	0.230	0.70	0.044

Test No. 1 — 4x4x8-In. — Hot Metal

Depth, in.	Drag Face S	Cope Face S
¼	0.012	0.048
⅜		0.016

Test No. 2 — ⅜ x 1¼ x 6-In. — Cold Metal

Si	Mn	S	P	Cu	Mg
3.98	0.49	0.030	0.220	0.66	0.045

Test No. 2 — 4x4x8-In. — Cold Metal

Depth, in.	Drag Face S	Drag Face Mg	Drag Face Mn	Cope Face S	Cope Face Mg	Cope Face Mn
¼	0.016	0.051	0.50	0.500	0.58	0.51
⅜				0.438	0.46	0.50
5/16				0.286	0.29	0.51
½				0.045	0.06	0.51
15/16				0.017	0.048	0.50

ized at the cupola spout with fused soda ash, and 200 lb of this metal was treated with magnesium alloy and inoculated with ferrosilicon to produce nodular iron.

A test block 4 x 4 x 8 in. was cast in a green sand mold and allowed to cool in the mold. This relatively large block was used to magnify any tendency of magnesium segregation within the casting. Cuts of 0.025 in. each were taken from the faces of the drag and cope. The results are shown in Table 1 and Fig. 1.

Because of the extraordinary segregation of magnesium and sulphur shown by this test, the work was rechecked using the same technique on another cupola melt of similar composition. To acquire additional information, two sets of blocks were poured at different time intervals. The first set was cast one minute after the magnesium treated iron was inoculated with ferro-

TABLE 3—COMPARATIVE MAGNESIUM DETERMINATIONS

	Magnesium, per cent			
	Drag Face		Cope Face	
Depth, in.	A. O. Smith	Chain Belt	A. O. Smith	Chain Belt
0.025	0.042	0.038	0.110	0.108
0.050	0.040	0.039	0.140	0.133
0.075	0.046	0.039	0.187	0.168
0.250			0.230	0.200
0.500			0.092	0.093
1.000			0.045	0.037

silicon. The second set was cast 7 min later. Both sets were cast from the same ladle. The only intentional variable was the metal time in the ladle.

Because of the elapsed time between castings the second set was poured at a lower temperature as compared to the first set. The desulphurized base metal before magnesium treatment had the following analysis: T.C., 3.36; Si, 2.29; Mn, 0.52; S, 0.090 (initial sulphur, 0.147); P, 0.230 per cent. In addition, two flat test bars $\frac{3}{8}$ x $1\frac{1}{4}$ x 6 in. were cast at the same time as the large blocks.

Each large block was broken in half and samples were drilled with a 3/16 in. diameter drill parallel to the longitudinal axis at different depths from the surface of the drag and cope faces. The small test specimens were drilled completely through the $\frac{3}{8}$-in. cross section. The chemical analysis results are shown in Table 2.

Analysis results show that segregation apparently is taking place constantly in both the ladle and the mold. If the mass of the casting is large enough, segregation is much more pronounced. In a casting of light section solidification proceeds with such rapidity that pronounced segregation does not occur. Furthermore, it appears that as the metal temperature drops, the segregation becomes more pronounced. This may result in an agglomeration of magnesium sulphide which becomes less soluble as the temperature decreases.

These tests clearly indicate that, because pronounced segregation can occur under certain conditions, in order to obtain a truly representative sample for foundry control of the chemical composition for magnesium and sulphur, a standard procedure of sampling should be established. It must be remembered that samples from individual castings may not be truly representative of the over-all ladle analysis.

The results indicate that an abnormal degree of segregation of sulphur and magnesium has taken place on the cope face of the 4 x 4 x 8-in. test block as compared to the drag face. To confirm our analyses, the magnesium content was checked by an independent laboratory (A. O. Smith Corp., Milwaukee, W. J. Poehlman, director of spectrographic research), using a spectrograph and applying the spectro-solution method. The comparative results are shown in Table 3.

Chapter Officers Set To Convene For Society's Midyear Conference

SEVENTH ANNUAL Chapter Officers Conference of A.F.S. will be held June 26 and 27 at the Stevens Hotel, Chicago, to discuss current and future activities of the chapters and the Society as a whole. Meeting with national officers and staff members under the chairmanship of President-Elect Walton L. Woody will be some 80 chapter officers who will hear talks and discuss chapter administration, Society technical activities, program building, AMERICAN FOUNDRYMAN, membership work and foundry education.

Participants in the two-day program will be the chairmen and program chairmen (in most cases they are also the vice-chairmen) of the Society's 40 chapters in the United States, Canada, and Mexico.

Urge Prompt Selection Of National Nominating Committee Candidates

ELIGIBLE CHAPTERS should forward names of candidates for the 1950-51 Nominating Committee to the National President not later than July 1 as prescribed by Art. X, Sec. 1, of the By-Laws: "*The Board of Directors of each Chapter eligible to have a member on the Nominating Committee shall annually select two candidates for the Nominating Committee from the Chapter membership, preferably representing different branches or divisions of the industry within the membership. The names of the candidates shall be forwarded to the President on or before July 1 of each year.*"

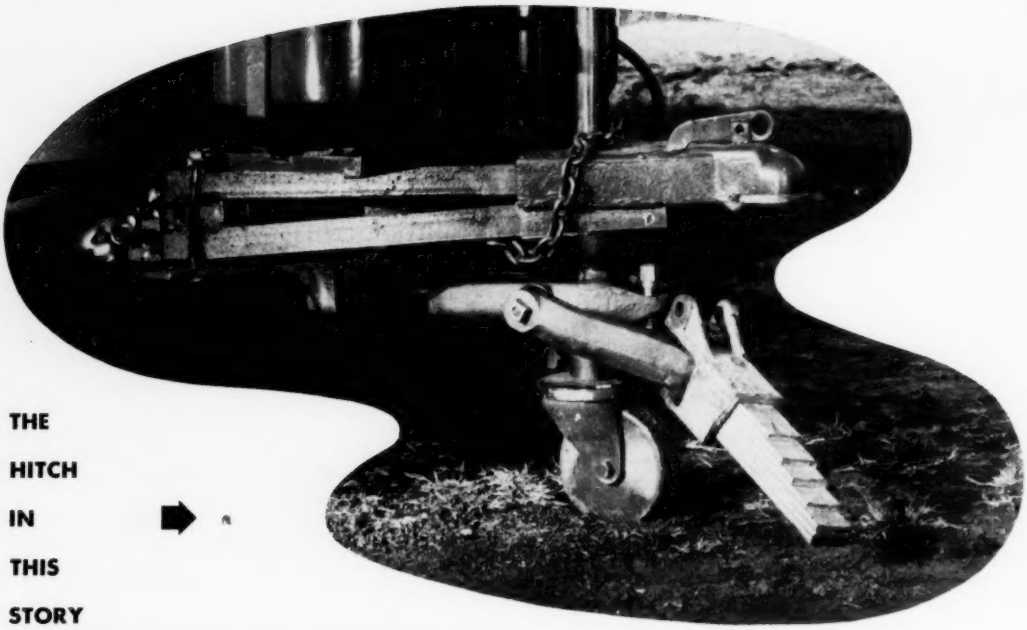
Eligible chapters are those not represented on the Nominating Committee during the past two years. The By-Laws provide that from the list of eligible candidates submitted by the various Chapters, the Executive Committee of the Board of Directors shall appoint six members to the Nominating Committee.

Chapter chairmen who have not already done so are urged to call Board meetings to select Nominating Committee candidates. Names should be forwarded to Walton L. Woody, President, American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill.

AFS Mexico City Chapter Relocates Headquarters, Sets Meeting Dates

NEWLY-LOCATED IN the Chemical Engineering Society of Mexico building at 55 Serapio Rendon St., Mexico City, the A.F.S. Mexico City Chapter held its first meeting in the new location May 3. Features of the meeting were a showing of a motion picture, "Design of Steel Castings," and a discussion of a translation of the A.F.S. publication ANALYSIS OF CASTINGS DEFECTS, recently made by N. S. Covacevich, chapter secretary.

All future chapter meetings will be held at the new headquarters on the first Wednesday of each month.



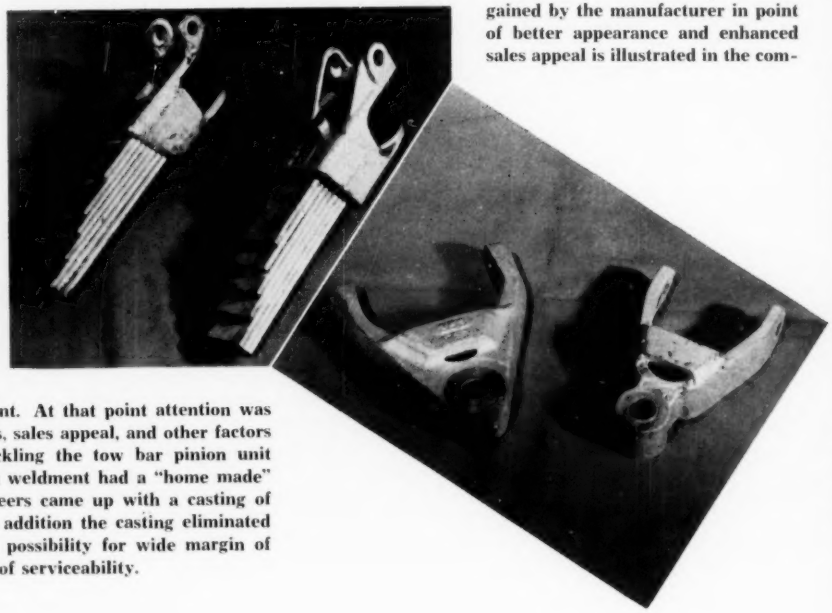
THE HITCH IN THIS STORY

MODERN FOUNDRY METHODS...

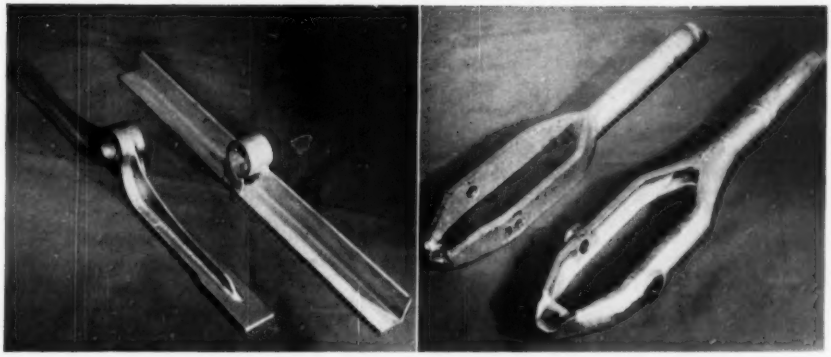
How product engineering pays off and how "Castings Can Do It Better" is shown in this story of Unitcast Corporation's (Toledo) redesign of a trailer hitch to take advantage of cost reduction and improved appearance inherent in castings. The story is based on a product development report taken from the files of the Steel Founders' Society. In brief the story is: A foundry engineered redesign of a trailer hitch unit, which began with consideration of how to achieve required improvements in a single part, culminated in redesign of all four parts and development of a completely new assembly which materially increased a small manufacturer's sales.

Unitcast entered the picture after the inventor and manufacturer had completed basic design and a welded pilot model of the car-trailer attachment. At that point attention was given to production costs, sales appeal, and other factors such as durability. Tackling the tow bar pinion unit (above, left) which as a weldment had a "home made" look, the foundry engineers came up with a casting of superior eye-appeal. In addition the casting eliminated lost time in fabrication, possibility for wide margin of error, and any question of serviceability.

The manufacturer then called for complete redesign of the trailer hitch and conversion to castings. The pinion yoke (below) was next. The two inside components in the illustrations show the smoothness and simplicity of the cast design. Finally the yoke carrier and the rear yoke part (left and right, top of facing page) were converted to castings as shown at the extreme left and right of the illustration. All around improvement gained by the manufacturer in point of better appearance and enhanced sales appeal is illustrated in the com-



parative photograph below showing the completely converted trailer hitch (except for the yoke carrier which in actual use is fastened to the trailer tongue) in the foreground with the welded hitch in the background.



Total weight of castings, as reported by Unitcast, was five per cent less than that of the original welded units; total finished cost of the steel castings was about 20 per cent less than weldments; and machining costs on the castings were around 75 per cent less.

Mechanical properties reported by the Unitcast laboratory round out the story:

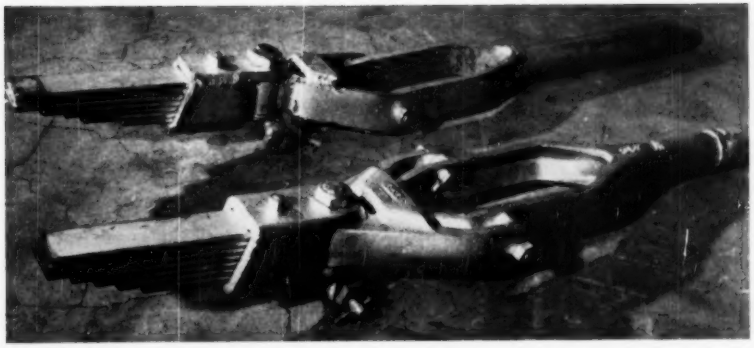
"Rear yoke casting—normalized. Casting (above, right) was blocked on extreme ends with compression load applied on the Y section. Casting showed no deformation up to 8,000 pounds load: 1/32 in. deformation experienced where additional 1,000 pounds was applied after 8,000 pounds, up to 12,000 pounds. Same part in fabricated form, under identical testing procedure, started to bend at 1,500 pounds, and was not useable for further test purposes due to permanent deformation."

Additional test was made of the complete assembly made up of steel castings, with the following results:

"Assembly was blocked at the spring fab section of channel and extreme end of rear yoke casting. Compression was applied at point of standard ball point loaded at 12,000 pounds. Entire compression load was taken up in the spring section fitted into the casting. No test beyond 12,000 pounds was considered necessary."

As a result of complete redesign of the trailer hitch, the small manufacturer is enjoying unprecedented sales inquiries in an off-season. And the responsible steel foundry is building small part volume on production orders for four parts instead of one—or none. This example of progressive accomplishment in foundry engineering may be measured by a universally understood yardstick—costs, as well as other factors such as weight reduction, improved appearance, strength, durability, and functional utility.

...MODERN FOUNDRY METHODS



PRODUCT DEVELOPMENT IMPROVES QUALITY AND SALABILITY, DECREASES COSTS

HOW TO BUILD STRENGTH INTO LARGE PATTERNS

Alfred E. Wells
Pattern Shop
Dominion Engineering Works
Montreal, Canada

AFTER THE PATTERNMAKER has decided on the shrinkage, molding method, coring system and various other details, he must make the final and most important decision—how to construct the pattern. Most important because good judgment used in making other decisions may be nullified by poor construction. Fortunately, most craftsmen are well versed in the sound and economical construction of smaller patterns, which are in the majority, but good construction methods for larger patterns seem to be less perfectly understood.

Well engineered larger patterns usually cost no more than an indifferent job, frequently less, while possessing greater strength and durability and better molding characteristics. The difference lies mainly in closer attention to apparently small details of design which tend to take the best advantage of the inherent strength of the pattern materials.

Every large pattern is a problem in itself, but perhaps 90 per cent are constructed by the gable and stave, or sheathing method. The interior of the pattern consists of a number of frames or gables which are covered by a comparatively thin skin, referred to as staving or sheathing, in much the same way that a wooden house is built by framing and sheathing. The pattern will be required to absorb a concentrated load, and the frames or gables must be designed to minimize the chances of distortion or total failure.

Design for Structural Strength

Perhaps the simplest gable is the square form shown in Diagram A—four pieces of wood of appropriate size fastened at the corners by small battens nailed in place. Similar gable construction can be found in many foundries, and yet it is used here as an example of poor construction. The design is definitely faulty, lacking lateral strength and offering little or no resistance to torsional stress. The fastenings are so placed as to invite rather than prevent structural failure. Diagram B shows a gable of similar shape designed to overcome these faults and give added strength to the whole structure, yet containing but little greater weight of lumber.

The upper and lower members of this gable are checked into the side members instead of being butted against them. This has the effect of transferring, part of any stress applied to upper or lower members to the side members equally. In the construction shown in Diagram A stress applied to a member which is not checked into other members must be taken up by the fastenings—the weakest part of the structure.

NOTE: This paper was presented, with other prize-winning entries in the Annual Technical Paper Contest of the A.F.S. Eastern Canada Chapter, at the Apr. 8, 1949 Chapter meeting.

This weakness is further enhanced by the manner in which the fastenings are applied—placing the nails in a line which coincides with the grain of the wood invites failure by opening the grain at several points along the same line, the over-all effect of which is to split either the batten or the member, or both, under sudden shock or continued stress.

In the better designed gable (Diagram B) the battens are placed diagonally across the corners. This serves a double purpose, as in this position the battens not only tie the corners but also have the effect of a bracing which aids in absorbing torsional stress; at the same time they are presenting a greater nailing surface.

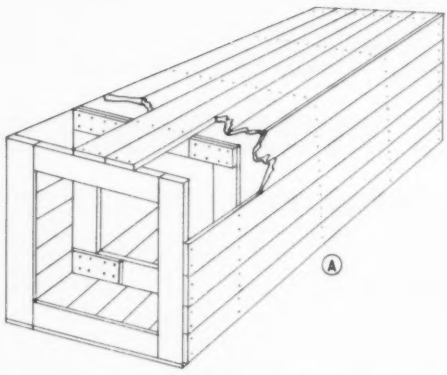


Diagram A—Top and bottom members of these square gables are butted into side members, with the battens square to the corners. The design is faulty in that it does not provide lateral strength and resistance to tortional stress.

Also, the fastenings are so staggered that no two are adjacent along the same grain line, either in the battens or the members proper.

Diagonal braces across each gable, and between two gables, may be incorporated. The purpose of this is self evident, but it is often overlooked. In practice it is well to add a further diagonal brace between opposite corners of each two gables if the job is of considerable size. If one brace between gables is considered sufficient it is well to stagger them, i.e., adjacent gables should have the brace running diagonally opposite.

A further refinement of design (Diagram B) is a series of gains or notches around the edge. The purpose of these notches is to house the longitudinal stringers which are used to bind and stiffen the structure. This method and the method of applying the stringers was developed by the writer some years ago and, while

it may not be original, he has never seen it applied to pattern making. The object of using stringers and the method of application is to put strength into the frame, instead of relying on the sheathing to carry a load for which it is poorly fitted.

In practice the longitudinal stringers are fitted to the notches and are themselves notched over the gable, so that between any two gables we have the effect not only of a stringer nailed across the face of the gable but also a series of studs or blocks fitted between the gables. Stress is taken on solid wood (not on the fastenings) and distributed throughout the structure.

The notched stringers also aid greatly in assembly. It will be found that machine-made square cuts automatically set the gables parallel and square. Also, the patternmaker is able to sheet the pattern in such a manner that the grain of the wood coincides with the direction of the draw, thus helping the molder. If the patternmaker could incorporate sufficient taper into his pattern to really please the foundryman,

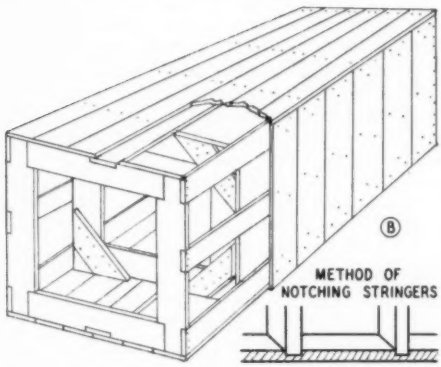


Diagram B—Designed to overcome the faults shown in Diagram A, this gable has top and bottom members checked into the side members, and the battens are attached diagonally across the corners. Stringers are notched into the gables.

longitudinal sheathing would be fairly satisfactory. Any slight warpage in the sheathing boards would be compensated for by amount of taper. However, the patternmaker must adhere rather closely to the engineers design and, by applying sheathing parallel to the draw, any warping which takes place in the sheathing boards offers no resistance, enabling a clean draw with a lesser degree of taper.

It is also possible to use lighter sheathing with this method of applying stringers. Heavy sheathing on poor gables is seen all too frequently, apparently in an effort to add strength by sheer weight instead of sound design, which tends to defeat the purpose by adding a passive strain on the framing in addition to the stresses set up in the molding process.

Previous to applying the sheathing, after the gables and stringers have been assembled, the whole structure should be braced by diagonal bracing properly fitted, preferably in cruciform fashion, between every second or third gable. This further stiffens the framework and distributes the stresses.

At this time provision should be made to carry rapping plates. It is poor practice to carry the shock of rapping on the sheathing, or on any single gable. Probably the best method is to carefully fit a stout block between two gables at the points which are chosen as most suitable. The block is carried to the height of the gables, and a stout stringer is placed across the block and extended across at least two adjacent gables. The whole is then braced to the opposite member of the gables involved. This arrangement transmits the shock of rapping across at least three gables and to the full depth of the pattern.

After placing blocks to take the rapping plates provision should be made for some form of drawstraps. The somewhat common method of screwing a metal drawstrap on the outside of the sheathing is poor practice. The few nails which secure the sheathing to the gables are called upon to support the whole weight of the pattern, in addition to overcoming the compressive force of sand in the mold, and the suction due to a partial vacuum in the mold at the time of draw.

Drawstraps should be designed to extend the full length of the draw, with a toe which extends under the pattern. If the pattern is of such depth that this is impracticable, the drawstrap should extend at least far enough for the toe to engage one of the stringers. Once again the stresses are spread over several gables.

Light Sheathing Used

Finally, the sheathing is applied—this need only be heavy enough to eliminate the possibility of spring between supporting gables. Heavy 2-in. sheathing laboriously screwed to each gable would seem to be a waste of good material, quite unnecessary when strength is built into the internal structure. This contention was amply borne out during the war when Dominion Engineering Co. supplied almost 200 large marine steam engines for use in the "Liberty Ships" being built in this country at that time.

In usual practice the bedplates for these engines, which also incorporated the main bearings, were cast in three pieces and bolted together, but by building strength into the pattern it was possible to save precious time and material by casting in one piece. This called for a pattern some 18 x 10 ft, with a depth exceeding 5 ft at the greatest dimensions, which is a big pattern in any foundry.

The bedplate pattern was in continuous use for almost 3 yr, and yet the 1⅛ in. pine sheathing proved so adequate that a fresh coat of shellac at widely spaced intervals was all the attention it ever received or needed. In applying the sheathing the patternmaker should carefully watch the grain of the wood. When wood warps it is normally curved to the outside of the tree, the convex face being to the heart. If the board is placed in such a manner that the inside or heart side is exposed, any warpage occurring from moisture absorption will result in the edges, which are the most vulnerable point, being forced together against the internal structure, thus tending to seal the joints rather than opening them.

AUXILIARY OXYGEN APPLIED IN 72 INCH PRODUCTION CUPOLAS

F. J. Webbere
Metallurgy Dept.
Research Laboratories Div.
General Motors Corp.
Detroit

RECENT DEVELOPMENTS in oxygen producing units, which promise to make large quantities of low-purity oxygen available at a fraction of the cost of the high-purity product, have aroused considerable interest in industries using combustion processes. After successful application in blast furnace, open hearth, and electric furnace operations, it was inevitable that the use of low-purity oxygen in the cupola would be considered.

The foundry industry has recently faced a period of generally subnormal cupola performance attributed to difficulty in the procurement of satisfactory raw materials, principally coke and pig iron. As a result of these adverse operating conditions, foundrymen became interested in the use of commercial oxygen for enriching the cupola blast. This interest was justified on the basis of favorable information appearing in the literature which indicated that a substantial saving in coke was possible with increased output and higher metal temperature[1]. Also, oxygen could be used as an emergency tool in the event of cold metal, bridging, slagged over tuyeres, etc[2].

Unfortunately, the investigations so far reported have been limited to the smaller cupolas and to relatively short periods of enrichment. No actual experimental data have been available for predicting the effect of an enriched blast in a large production cupola. This situation has prompted the publication of the results from a series of large-scale tests sponsored by the Chevrolet Grey Iron Foundry, Saginaw, Mich.

Large-Scale Tests Made

The actual experimental work at the Chevrolet foundry was performed prior to the publication of any test results of an oxygen-enriched blast in this country. The tests were conducted on two cupolas, each lined to 72-in. diameter at the bosh and normally operating for a continuous period of 18.6 hr. In the longest of these tests oxygen was added at a constant enrichment for 15.3 hr. These appear to be the only tests of this magnitude that have been made. The conclusions indicated by this investigation have already been advanced in the technical literature[3]. The present paper is intended to justify those conclusions and to present operating data relevant to each test.

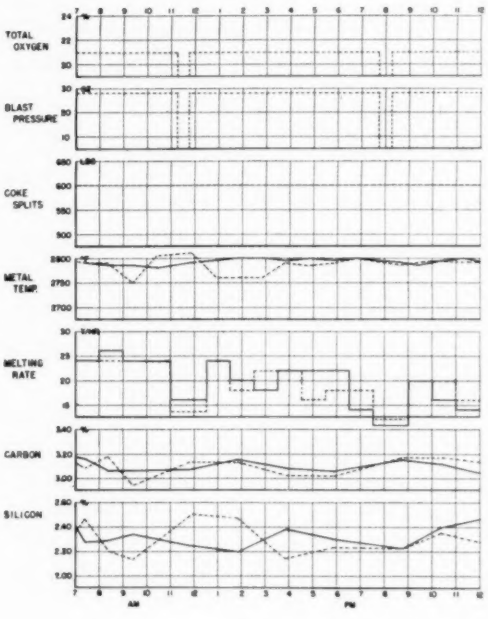
Cupola performance and the properties of the resulting iron were studied from tests made with the oxygen content of the blast increased by increments of 1.0, 1.7, and 2.8 per cent, bringing the total oxygen content of the blast to 21.9, 22.6, and 23.7 per cent, respectively. Facilities for supplying larger additions for extended tests were not available, and it was felt that the cost of oxygen would be prohibitive for larger additions even if the effect should be favorable.

Furthermore, reports of foreign investigators had pointed to a definite maximum performance in both iron output and coke economy within the range of 1 to 3 per cent enrichment[1]. There was also some concern about refractory life at greater enrichments and the possible loss of a production run due to premature burn-out. Higher enrichments for shorter periods were therefore not considered.

In the interest of coke conservation, the principal objective of these tests was to determine the minimum coke required at each level of enrichment to maintain normal conditions with regard to temperature and composition of the iron. Each test was begun at a coke ratio known to be satisfactory. After steady operation was obtained, the coke was reduced and conditions again allowed to stabilize. Further reductions in the coke splits followed until evidence of a coke deficiency appeared.

In all tests, pure oxygen was piped to the cupola from mobile tank trailers through a 3-in. line which entered the blast main at a point 7 ft from the windbox.

Fig. 1—Cupola performance with 20.9 per cent oxygen in the blast. Normal operation on consecutive days.



This report is the tenth in a series of articles dealing with modern cupola operation which has been prepared or procured by the Cupola Research Committee of A.F.S. for publication in *American Foundryman*.

The pipe was projected 12 in. into the blast main normal to the axis and terminated in a perforated diffuser plug. The flow of oxygen was maintained from orifice manometer readings after appropriate corrections for temperature variations. The blast itself was supplied by a bank of positive displacement blowers.

Control of the blast was possible only on the basis of pressure which was manually regulated with a bleed-off valve in the blast main. This lack of automatic regulation of the blast air prevented a continuous check on the degree of oxygen enrichment, but actual determination of the oxygen content by absorption methods showed reasonably good agreement with the intended enrichments. Due to the configuration of the blast main, measurement of the air volume with a Pitot tube was not satisfactory.

Comparison Basis Established

Two cupolas assigned to this study were in alternate use to allow relining during the off day and, since there was no detectable difference in their normal production history, this interchange was made with confidence. A satisfactory base for evaluating the effect of oxygen was established by observing the cupolas during normal operation for 2 days preceding and 2 days following the test with 21.9 per cent total oxygen. This information, along with the over-all production record of these cupolas, provided the necessary basis for comparison. Typical data for normal operation of these cupolas are shown in Table I. These conditions stipulated for normal operation were reproduced in the tests with the exception of the coke splits and the limestone.

The initial bed height for all the tests was 52 in. above the tuyeres and required 5800-6200 lb of coke. The blast was turned on at about 5:10 a.m., but no oxygen was added to the blast until shortly after 7:00 a.m. to allow stabilization of operating conditions before introducing the effect of increased oxygen. Except for this limitation, oxygen additions were begun as early as possible in order to take full advantage of cleaner melting which seemed to characterize the use of supplementary oxygen. Following the period of enrichment, blast pressure was varied as needed. This accounts for the irregularity in the pressure curves for

TABLE I—TYPICAL DATA FOR NORMAL OPERATION

Cupola	72 in. diameter at bosh
Blast	Positive displacement blowers (Manual bleed-off control)
Blast pressure	28 oz at windbox
Tuyeres	Continuous
Charge analysis (%)	20.0 steel flashings
(4000 lb total)	23.7 pig iron
	1.1 spiegel iron
	25.0 briq. C.I. borings
	30.0 piston iron returns
	0.2 ferro-phosphorus
Iron analysis (%)	3.10-3.60 total carbon
	0.40-0.70 combined carbon
	0.40-0.60 manganese
	0.10-0.30 sulphur
	0.11-0.18 phosphorus
	2.20-2.65 silicon
	0.15-0.25 nickel
	0.10-0.20 chromium
Coke splits	600-650 lb (300-325 lb/ton)
Limestone	160-200 lb

Fig. 2—Cupola performance with 21.9 per cent oxygen in the blast. Nominal enrichment—1 per cent oxygen.

the tests with 22.6 and 23.7 per cent oxygen (Figs. 3 and 4).

Only with 1 per cent enrichment was sufficient oxygen available to continue enrichment for the duration of the production run, which netted a total of 15.3 hr of enrichment. For 1.7 per cent enrichment the test was limited to 7.7 hr, and with 2.8 per cent enrichment to 7.0 hr. In conducting these tests it was necessary to adhere to the normal production down periods for lunch and shift changes. This makes it injudicious to interpret the results in terms of absolutely continuous operation. On the other hand, the results are representative of operation under production handicaps and provide information of more immediate value.

The results of greatest consequence are shown in the accompanying performance charts (Figs. 1-4) for operation between 7:00 a.m. and 12:00 midnight corresponding to the approximate period from the start of the enriched blast to the end of the day's run.

Coke Savings: With a blast containing 21.9 per cent oxygen it was possible to cut the coke splits by 75 lb (37.5 lb per ton of iron) and to continue operation with reduced coke over a 12-hr period. With 22.6 per cent oxygen an attempt was made to reduce the coke by an equivalent amount, but three booster charges of 500 lb each were required during the period of enrichment, and during the last 2 hr the amount of coke per charge was increased to 550 lb.

More satisfactory performance could have been expected with a 550-lb coke charge throughout this run. At 23.7 per cent oxygen no significant saving in coke was obtained. It is significant that investigations with smaller cupolas have indicated peak coke savings at

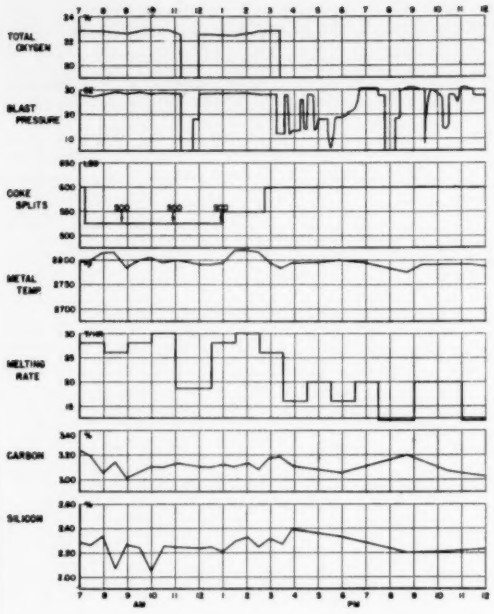


Fig. 3—Performance of cupola with 22.6 per cent oxygen in the blast. Nominal enrichment—2 per cent oxygen.

considerably greater enrichments[2-4]. The tests on the 72-in. cupolas point to optimum performance with less than 2 per cent additional oxygen in the blast. The experimental relationship between per cent oxygen enrichment and the minimum allowable coke charge is graphed in Fig. 5.

Metal Temperature: Although the literature had indicated considerably higher spout temperatures with the enriched blast, only a minor increase of less than 20 F was obtained in these tests. It is likely that a greater effect on temperature would have resulted if the coke had not been cut to a minimum.

Intermittent use of oxygen during a production trial of over 5 months in two cupolas of 32-in. and 40-in. diameter has been reported by Harrison and Wagner[5]. The oxygen was used primarily to prevent cold metal in casting relatively thin sections which required a minimum temperature of 2780-2800 F at the cupola spout. By careful supervision these cupolas could sometimes be operated for a full 8-hr campaign without the temperature falling below 2780 F. During other heats as many as four cold iron periods requiring oxygen were encountered. Complete recovery of temperature was obtained in 3 to 5 min with 4 per cent enrichment even though the metal temperature had in some cases dropped as low as 2650 F.

Difficulties with temperature variations of this order are rare in the 72-in. cupolas, and in view of the limited superheat obtained during the tests the use of oxygen in amounts of less than 3 per cent enrichment shows little promise as a means of temperature control in cupolas of this size.

Melting Rate: In order to properly evaluate the effect of the enriched blast on melting rate, it is essential to compare only correlated periods of operation for each test run. Due to the relatively short run with 2.8 per cent oxygen enrichment the comparison should be limited to the period from 7:00 a.m. to 1:30 p.m., excluding the lunch hour. On this basis, 1.0 per cent enrichment shows no increase in metal output, while 1.7 per cent and 2.8 per cent oxygen show an increasing but not proportional trend of 16.7 per cent and 20.0 per cent, respectively (Fig. 6).

It should be noted in Fig. 2 that with 1.0 per cent enrichment the melting rate did not fall off during the afternoon shift as is usual. It is not certain that this can be entirely attributed to the additional oxygen since the melting rate during normal production is frequently a reflection of metal demands at the pouring line, which are generally lower during the second shift. With the quality of coke available at the time of the tests, these cupolas were readily melting 24 tons per hour during the first shift, and no doubt could continue at that rate if the demand warranted it.

Chemical Analysis: The effect of oxygen enrichment on the chemical analysis of the iron was somewhat obscured by the practice of inoculating for chill control before sampling for chemical analysis and physical test. No major trend over the entire period of enrichment is apparent. A greater variation in both carbon and silicon occurred when oxygen was used, but the mean values are in line with normal operation.

With higher combustion temperatures and increased reaction rates the cupola appears to be more sensitive to normal variations in blast weight and the character of the charge burden. If specification limits are to be closely held, more positive control of these variables

Fig. 4—Cupola performance with 23.7 per cent oxygen in the blast. Nominal enrichment—3 per cent oxygen.

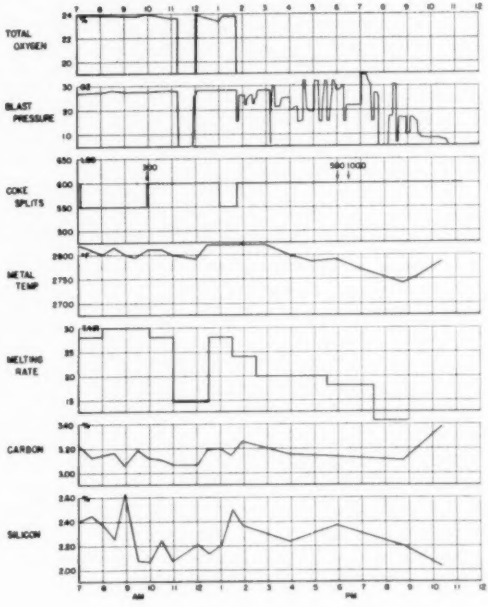


TABLE 2—SCHEDULE OF OXYGEN TESTS

Cupola No.	Enrichment, %	Oxygen in Blast, %
7	Normal blast	20.9
6	Normal blast	20.9
7	1.0 oxygen	21.9
6	Normal blast	20.9
7	Normal blast	20.9
7	1.7 oxygen	22.6
6	2.8 oxygen	23.7

will be required in the cupola using oxygen. The sulphur content of the iron was slightly lower during the enrichment periods. This would naturally follow the reduction in the coke charge.

Refractory Loss: Indications of cleaner melting with less slagging at the tuyeres were observed in all tests with increased oxygen. The height of the melting zone, as indicated by the burn-out, was reduced with somewhat greater localized penetration. In view of the increased output, the difference in lining burn-out was considered negligible.

The lining did burn completely through during the run in which 23.7 per cent oxygen was used, but this is not unprecedented in a cupola operating at such a high production rate. Wick reported[2] a limited control of refractory burn-out by adjusting blast volume, but the moderate refractory loss experienced in these large-scale tests did not seem to warrant a separate investigation of this phase.

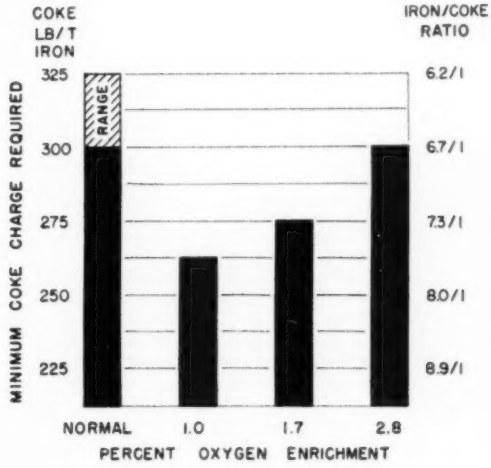
Physical Properties: Tensile strength, transverse strength, deflection, and Brinell hardness are virtually unaffected by the enriched blast. Somewhat greater variation was observed in the depth of chill during enrichment, but no quantitative comparison could be made. No adverse effects on fluidity were noted.

Oxygen in Large Vs. Small Cupolas: From the performance charts (Figs. 2-4) it is apparent that considerable time is required before the full effects of the enriched blast are attained. In the case of the 1.0 per cent enrichment, melting rate in particular did not reach a maximum until 2 to 3 hr after enrichment was begun.

Slower response of large cupolas may rule out the inoculation treatment proposed for "curing cupola ills." Although the effect of the enriched blast on the time from blast-on to first-tap was not investigated, this time was reported to be materially reduced in a smaller cupola[4] and would likely have shown a similar effect in the 72-in. cupola.

The advantages of the oxygen enriched blast in the 72-in. cupola do not appear to be as great as in the smaller cupolas which have lower thermal efficiency and possibly lower operational efficiency. It can be safely inferred that any increase in performance that might result from oxygen additions will be related to the normal efficiency of the particular cupola. This will vary widely from plant to plant even for cupolas in the same size category, depending on metal charge factors such as size, included dirt, melting point, etc.

Fig. 5—Coke requirements with oxygen enriched blast.



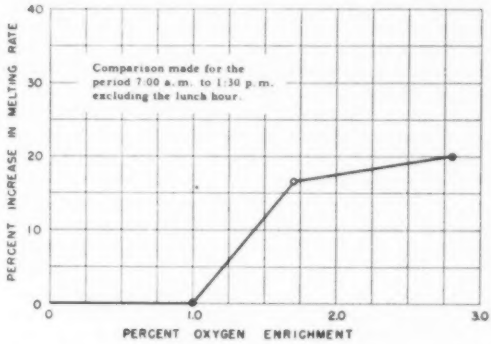


Fig. 6—Effect of enriched blast on the melting rate.

In general, coke savings, increased spout temperatures, increased output, and the possible advantage of intermittent use appear to be greater in the smaller cupolas. The principal disadvantages—refractory loss and unit cost of oxygen—would be minimized in the larger cupolas. In addition, the maximum effects of the enriched blast in a large cupola, although not so great in magnitude, appear to be obtained at a lower order of enrichment[6] and may prove to actually balance the relative economics over the entire size range of commercial cupolas.

Cost of Low-Purity Oxygen: As yet there is no general formula by which the dollar value of oxygen can be predicted since the advantages that accrue from its use will have varied importance from foundry to foundry depending on metal composition, type of castings produced, and the over-all scope of operations. In many foundries coke savings may be accepted as the only tangible source of returns from the use of oxygen, and in such cases it will be difficult to justify the installation of oxygen producing equipment.

In the 72-in. cupola tests best performance was obtained with 1 per cent enrichment which permitted a reduction of 12½ per cent in the coke charge. In the 15.3 hr during which oxygen was used, the total oxygen

consumption was 114,278 cu ft or 4.76 tons. During this same period 384 tons of iron were charged with a coke saving of 37.5 lb per ton, or a total of 14,400 lb of coke saved.

With coke cost at about $20.00 per ton this represents a saving of $144.00 through the use of 4.76 tons of oxygen, or a break-even figure of about $30.00 per ton for the oxygen used. This is what a large foundry could afford to pay for oxygen as a result of coke savings, not considering the cost of additional control and more stringent supervision, and assuming that present production quotas, metal temperatures, and operational figures are satisfactory.

Oxygen Production Cost

The actual cost of producing oxygen at the plant site has not yet been bracketed. A recent report from a chemical plant in Texas operating a unit producing 175 tons of oxygen per day at 90-95 per cent purity quotes a cost of $5.00 per ton of oxygen produced[7]. A special report by P. C. Keith and P. W. Wilson[8] includes an estimate of $3.50 per ton for a plant of this size. These figures are far too optimistic to use in the prediction of costs for foundry usage since no existing foundry operation can utilize oxygen at this rate. However, there is an indication that the cost of oxygen is reaching an attractive range for widespread commercial application.

Chevrolet Grey Iron Foundry now has seven 72-in. cupolas in operation each day. The use of auxiliary oxygen in all seven cupolas for the normal run of 18.6 hr at the same rate as in the test run with 1 per cent enrichment would require 40.6 tons per day. The nominal capacity of the oxygen plant required would be about 50 tons per day, entailing either a serious storage problem or excessive waste since the present production of low-purity oxygen is essentially a continuous process and not readily adaptable to stoppages.

Extrapolation of the data presented by Keith and Wilson[8] results in an estimate of $6.00 to $8.00 per ton for continuous production of oxygen at 50 tons per day, and will be notably greater for a foundry installation where oxygen consumption would not be steady. A very conservative estimate of the cost of oxygen was given in an early report by Wick in which one of the large producers of oxygen was quoted at $33.60 per ton for a foundry using oxygen at the rate of 48 tons per day.

It is apparent that the continuous use of auxiliary oxygen cannot, at this stage, be endorsed for large production cupolas, and even intermittent use appears of doubtful economic advantage for large-scale operations. The fact that the use of oxygen is a distinct departure from conventional foundry expedients should not be minimized. More extensive investigation of operating conditions and development of specialized cupola design may reveal sufficient advantage to make either continuous or intermittent use of oxygen universal practice in the foundry industry.

Acknowledgments

The oxygen enrichment tests in the Chevrolet Grey Iron Foundry were conducted with the cooperation of the Air Reduction Sales Corp., and the Koppers Construction Co. Representatives of the Cupola Research Committee of the American Foundrymen's Society, and the Research Laboratories Div. of General Motors Corp. were present as observers. This report of the investigation is based largely on Research Laboratories Div. Reports No. MR-74 and MR-78.

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7. "$5 a Ton Oxygen," *Journal of Metals*, vol. 1, no. 6, June, 1949, p. 207.

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Future Meetings and Exhibits

University of Michigan School of Public Health, in-service training course in industrial hygiene and human relations for safety personnel, Ann Arbor, Mich.—June 19-21.

Malleable Founders' Society, annual meeting, The Homestead, Hot Springs, Va.—June 22-23.

American Society for Testing Materials, annual meeting and exhibition, Haddon Hall, Atlantic City, N. J.—June 26-30.

National Association of Foremen, annual meeting, Hotel Statler, Buffalo, N. Y.—Sept. 13-18.

Instrument Society of America, fifth national instrument exhibit, Memorial Auditorium, Buffalo, N. Y.—Sept. 18-22.

Steel Founders' Society, annual fall meeting, The Homestead, Hot Springs, Va.—Sept. 25-26.

Association of Iron and Steel Engineers, annual convention and exposition, Cleveland Public Auditorium, Cleveland—Sept. 26-29.

All-Canadian Foundry Conference, sponsored by A.F.S. Eastern Canada and Ontario Chapters, Hamilton, Ontario—Sept. 28-29.

Gray Iron Founders' Society, annual meeting, Netherland Plaza Hotel, Cincinnati—Oct. 12-13.

Foundry Equipment Manufacturers Association, annual meeting, The Greenbrier, White Sulphur Springs, West Virginia—Oct. 12-14.

Non-Ferrous Founders' Society, annual meeting, Hotel Statler, Boston—Oct. 13-14.

Texas Regional Foundry Conference, sponsored by A.F.S. Texas Chapter, Plaza Hotel, San Antonio, Texas—Oct. 5-6.

American Society for Metals, national metal exposition and Congress, International Amphitheater, Chicago—Oct. 23-27.

Metals Casting Conference, A.F.S. Central Indiana and Michiana Chapters and Purdue University, at Purdue, West Lafayette, Ind.—Nov. 2-3.

Steel Founders' Society, annual technical and operating conference, Carter Hotel, Cleveland—Nov. 9-11.

TIME STUDY AND STANDARDS AID FOUNDRY PRODUCTION PLANNING

J. J. Farkas
Foundry Division
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

TIME STUDY MAY BE DEFINED as a scientific analysis of methods and equipment used in doing a piece of work, development of the best manner of doing it, and determination of the time required. Standards may be defined as just compensation expressed in terms of time to be paid a properly trained operator for doing a piece of work of acceptable quality, under conditions dimensioned as to methods, equipment, and working conditions. From the foregoing definitions, it follows that the application of time study and standards assumes an intimate knowledge of the time required to perform a given task under all conditions.

Analyze the Job

Production planning may be acceptably defined as the mental labor expended in determining what work is to be done, how, where, and when it is to be done to attain a product of the desired quality, at lowest possible cost, ready for delivery at some predetermined and contracted date. Since it is intended to discuss scheduling (when the work is to be done) separately, the discussion of production planning is to be limited to consideration of the factors dealing with what, how and where the work is to be done. Thus, production planning as related to the foundry constitutes an analysis of a given job as to routing, rigging, and pattern equipment.

The term routing, as considered here, is the determination of the processes, methods, and equipment to be used in performing a given task, resulting in a product of acceptable quality at the lowest possible cost. It is evident then, that routing a given casting through the foundry necessitates analysis of molding, core making, core setting, shakeout, core knockout and casting cleaning practices and, based on that analysis, making a choice of practices and equipment.

Routing the Work

Neglecting the influence of overhead and burden charges, the relative costs of making a casting in a number of ways is nearly directly proportional to the lengths of time required by the various methods, in other words, nearly directly proportional to the time-study standards. Thus, routing a casting through a foundry is a direct function of time-study standards.

To illustrate, assume an instance in which the pattern is adaptable for molding either by method (A) or method (B), where the standard for molding by method (B) is greater than for method (A). Neglecting overhead and burden charges, we should naturally route the job to method (A). Assuming further that the job is readily adaptable to method (B), but made adaptable to method (A) only by the expenditure of additional labor and material, we would hesitate to route the job to method (A) unless it was obvious that the differential in standards was great enough to justify the additional expense. In the event that the expenditure could not be justified, the obvious choice of routing would be to method (B).

The factors discussed so far must be accepted only as a general rule. Overhead and burden charges can not be neglected in all cases. To illustrate, relative costs of making a dry sand casting and green sand casting could not be compared on the basis of time-study standards alone, since overhead and burden charges are not comparable. The higher overhead and burden charges arising from the greater amount of equipment, materials, and supplies places dry sand molding at an immediate cost disadvantage. As a result, should a choice in routing lie in two such extremes as dry sand and green sand molding, the choice must be made on the basis of comparative total costs, including overhead and burden. In the foregoing illustration, the assumption is that both methods will result in a casting of the required quality.

While molding practices have been chosen to illustrate the foregoing points, and even though it is recognized that there are a great many molding practices (slip flask squeezer, pin lift, jolt rollover, slinger, along with a number of variations of these methods), it must also be borne in mind that a great number of practices are in effect in core making, core setting, core knockout, and casting cleaning.

Planning the Rigging

Rigging may be subdivided into two categories. The first category would include that phase of rigging which is a function of equipment available and/or management policy, and is therefore not subject to planning on a job-to-job basis. In illustration of this particular phase, some foundries mount patterns on insert boards or steel plates which are inserted and quick clamped to the bed or table of a molding machine; others prefer to or, due to equipment limitations, use C-clamps to hold the pattern board or steel plate to the bed or table of a molding machine.

Obviously, as lot orders shrink in quantity, and number of set-ups increases, the advantage lies with the insert board or steel plate. To further illustrate the first category, some foundries prefer to rigidly mount risers, ingates, and runner bars integrally with the patterns; others prefer to handle them separately and place them at discretion. From a molding cost viewpoint alone, the advantage obviously lies with rigidly mounted risers, ingates and runner bars, since this method would eliminate handling and placing.

Many of the important applications of "Time Study and Standards," other than wage incentive determinations, are sometimes overlooked. One of these uses—foundry planning and scheduling—is covered by this article, sponsored by the American Foundrymen's Society Time Study and Methods Committee, of which the author is a member.

It is not the intent in this paper to discuss equipment and predetermined practices, but rather to show what can be accomplished under a given set of conditions by job-to-job planning. Our principal concern is that phase of rigging which deals with deciding upon a method of handling a given pattern to insure a good casting at low cost.

At this stage of the planning the choice of equipment and practices has been made, and the routing established. In general, at this point planning is limited to determination of the best method of handling the pattern. It is apparent that whatever savings are to be attained at this point must be derived from reductions in the costs of molding, core setting, iron pouring, and mold shakeout operations.

Our consideration of rigging will then consist of determining whether the pattern shall be rigidly mounted on a board or steel plate, and whether the pattern shall be reproduced for ramming more than one pattern in a mold. Obviously, before any decision can be made due consideration must be given to the costs involved and the total savings attainable.

The bench department of this metal pattern shop is equipped with flexible grinders and compressed air lines, both suspended from the ceiling and within reach of all benches. Pattern making time is closely controlled. (Courtesy of City Pattern Works, Detroit.)

Pattern Mounting Costs

Rigging costs are governed by the type of pattern involved. For a given size pattern a lesser saving can justify mounting a flat-back pattern, a slightly greater saving is necessary for mounting a split pattern, and a much greater saving for mounting a solid pattern requiring a mold with irregular parting. Since we can here discount the influence of overhead and burden charges, the attainable savings can be expressed in terms of time-study standards differentials. Furthermore, the pattern shop or rigging shop expense can be expressed in terms of the time-study standards, and a convenient formula, with time-study standards as the common denominator, derived as a guide in determining feasibility of mounting.

As an example, assume that the problem is to determine whether it is economically sound to mount a split pattern to be run on a jolt-squeeze machine, using slip flasks. Let us further assume that rigging expense will accrue at the rate of $3.00 per hour, while molding costs are $4.50 per hour. This immediately establishes the fact that for every hour spent on rigging, at least two thirds of an hour must be saved in making the casting to justify the expenditure. It is further assumed that it will take 2 hr to mount the pattern; that 4 min per casting can be saved by mounting; and that 25 castings are to be made.

The total attainable saving is 4 x 25 or 100 min, while the expense incurred (expressed in terms of time-study standards) is 2 x 60 x 3.00/4.50 or 80 min. It is evident in this case that mounting the pattern is justifiable. Using the same line of reasoning, it can be determined whether it is economically sound to mount flat-back patterns, whether a hard sand match or metal match plate should be made in place of an irregularly parted solid pattern, and so on.

In considering the reproduction of multiple patterns the same reasoning must be followed, bearing in mind that successive patterns can be made at less cost than the first, since core boxes generally will not have to be reproduced. Also, even though we have dealt with mounting and multiple patterns separately, the two are related in that under certain circumstances it may be more economical to make two patterns and run them both loose rather than mounted; or as is an excellent practice in some foundries, to mount several different patterns on a board or steel plate for ramming in the same flask.

However, regardless of what conditions or combination of conditions are to be considered, the decision can be made on the basis of the following formula: hours saved per piece times number of pieces must equal or be greater than the product of hours spent in rigging times rigging burden rate divided by molding burden rate.

Pattern Equipment

As a result of the routing and rigging analyses, the pattern equipment is defined as to number, nature, and rigging. The choice of method in making a pattern is a function of the number of pieces of casting to be made, anticipated pattern maintenance costs, and casting dimensional accuracy and finish required.

When dealing in lot quantities of one, two, or three castings to be made from a given pattern, obviously expensive metal or mahogany patterns would not be considered. However, there may be some question as to whether the pattern should be parted, whether leather, wax, or even no fillets should be used, and even as to the extent pattern surfaces should be finished (references to patterns and pattern equipment are meant to include core boxes, etc.).

The choice of pattern equipment may appreciably influence casting manufacturing costs, and these effects must be weighed against the accompanying pattern costs. Thus, particularly when very low casting quantities are involved, many decisions affecting pattern making can be made on the basis of comparative time-study standards.

In the case of long-run jobs, should a choice be necessary it can be made on the basis of estimated pattern maintenance expense to be accrued over a period of time in one case as compared to another. Usually, with this type of equipment manufacturing costs remain constant, even though different materials may be used in making the patterns.

Work Scheduling

Scheduling may be defined as the injection of work into process at such a time as will insure the delivery of a product at some predetermined date. As related to the foundry, scheduling is the process by which, starting with a known delivery date, a timetable is developed for processing a casting, and for making pattern equipment. Basically, scheduling a foundry is a process of working backward from a predetermined delivery date, utilizing data pertaining to the time required in processing a casting to determine when to start processing; and working backward from the date of process starting to determine when to start work on pattern making.

The time required, as well as time-study standards, within a given foundry practice, is a function of the size and complexity of a casting. Thus, by expressing time-study standards in terms of time, and by adding other processing cycle times such as baking and cooling cycles, the total time needed to process a casting can be readily determined. It would be impractical, if not impossible, to compute the processing times for each casting passing through the foundry.

Classify Castings for Routing

The practical solution is to classify the castings, using routing as the common denominator. Analysis of total processing times for a number of different castings within a given routing should result in a fairly accurate forecast of processing times for all castings to be made within that particular routing. Some few exceptions to the rule will occur, but these must be disregarded in the face of the tremendous advantage afforded by its use. In the author's foundry casting processing times are classified as squeezer green sand; small jolt, rollover dry sand; medium jolt rollover dry sand; large jolt rollover dry sand; and pit molding.

Core-making cycles, since they include core ramming, baking, and in some instances, finishing, assembly, and re-baking, generally are longer than the accompanying molding cycles. For this reason, cores must be scheduled ahead of molds. The extent of this lead is a function of the amount of work and practices involved, and core-making capacity.

The amount of work and the percentage of capacity represented by that work is readily computed from time-study standards. As the amount of work approaches capacity the lead must be increased, since at all times sufficient cores must be on hand to maintain a given molding schedule. Since it would be impractical, even if not impossible, to subject each casting to such analysis, the practical approach is to classify castings into groups and determine average leads for each group, and this lead must be determined as accurately as possible.

Should the lead be too long, unnecessarily large core inventories will accumulate, resulting in storage problems, possible loss of cores through handling in storage, and possible scrapping of cores because of design or practice changes. Should the lead be too short, molding schedules would be disrupted due to a build-up of unpoured molds, flask turnover, and congestion on the mold assembly and pour-off floors.

Mold scheduling is a direct function of molding capacity. Should a mold schedule in excess of molding capacity be adopted, a build-up of core inventory to the extent of jobs not molded would result, with attending disadvantages. On the other hand, should a mold schedule under capacity be adopted, considerable labor wastage would occur.

To insure that the amount of work scheduled balances the capacity, it is necessary to have some device for measuring it. Here, too, time-study standards are a function of the work involved, and their application to the task should result in an accurate evaluation of the quantity of work required. As in foregoing illustrations, this analysis on a job-to-job basis would be impractical, and it is practical to classify castings into groups and express capacity in terms of numbers of molds attainable per day.

Conclusion

On the basis of analysis of time-study standards the author's foundry has found it possible to classify molding capacities, in every instance but one, on the basis of routing. Thus, molds are scheduled on the basis of an average number of molds per day capacity for squeezer molding, small jolt rollover, medium jolt rollover, and pit molding. The only exception is in large jolt rollover molding, where it is necessary to subdivide and classify molding capacities by flask size groups.

Cupola and sand conditioning operations may be adversely affected by careless casting scheduling, particularly where they are being performed continuously and integrally with other foundry operations.

In scheduling pattern making it must be borne in mind that the time required to make a pattern is a function of size, complexity, quality, and rigging. Therefore, in those instances where incentive rates for pattern making have been developed by time-study methods, scheduling can be established as a function of time-study standards. However, in those cases where no time-study standards exist for pattern making, it is possible to relate required pattern hours to molding and core making standards and to forecast the time for a given pattern as a function of those standards.

Young foundrymen working at Montreal Technical School which figures largely in Eastern Canada Chapter educational activities. Molder at far left is Richard C. Tracy, fourth year apprentice at Dominion Engineering Works, Ltd., Montreal, Que., who placed first in steel molding in this year's A.F.S. Contest.

CHAPTER EDUCATIONAL ROUNDUP

Apprentice Contest, Sand School Highlight 1949-50

EDUCATIONAL ACTIVITIES of the American Foundrymen's Society—carried on through the chapters and the national committees of the Educational Division—are widespread and cover participation in the Society's Annual Apprentice Contest, aid to students, cooperation with A.F.S. student chapters, chapter educational courses, regional foundry conferences, publicizing castings and the industry through exhibits and plant visitations, establishment and maintenance of student loan funds, and development of foundry laboratories and courses in educational institutions.

During the past year most A.F.S. chapters carried on one or more of these educational activities with particularly heavy participation in the Apprentice Contest and in short courses on foundry sand testing and use. Ten chapters held local apprentice contests with young employees of 77 plants competing, along with those of 21 foundries which held in-plant contests, in this year's competition. Total number of contestants was 259.

Chapter apprentice contests were held by: Detroit, Eastern Canada, Michiana, Northeastern Ohio, Northern California, Northern Illinois-Southern Wisconsin, Ontario, St. Louis District, Southern California, and Wisconsin. Winners in the five contest divisions were reported in the May issue, page 60; winning patterns and castings and other interesting entries will be pictured and discussed in an early issue of AMERICAN FOUNDRYMAN.

While many chapters repeated their popular educational courses of other years, a number sponsored three or four day sand schools put on in cooperation with Harry W. Dietert Co., Detroit. Often co-sponsored with an educational institution, these short courses were attended by up to 100 foundrymen who came to learn more about making and interpreting sand tests. Lecturer and demonstrator for the sand schools was either Harry W. Dietert or Frank S. Brewster of Harry W. Dietert Co.

Dean N. W. Daugherty, University of Tennessee, Knoxville (left), receives certificate commemorating presentation of library of A.F.S. publications to the engineering school by the Tennessee Chapter from Chairman Karl L. Landgrebe, Wheland Co., Chattanooga.

Among the chapters sponsoring sand schools were Philadelphia, Central Ohio, Ontario, Detroit, St. Louis District, Oregon, Texas, Northern California, Birmingham District, British Columbia, Southern California, and Central Michigan. At Philadelphia, the sand school was first in a round of short courses held instead of the usual lecture series of 15 to 20 sessions. Object of the change was to bring to each short course a group

of foundrymen with common interests and backgrounds for a concentrated dose of technical information on some limited phase of foundry practice.

Typical of the sand schools was that held at the University of Alabama under the sponsorship of the university and the Birmingham District Chapter. As reported by Frank Lane, Stockham Valves & Fittings, Birmingham, the first two days were spent in technical discussion of all aspects of sand control. Concluding the three-day session was a castings defect clinic during which scrap castings were examined. Defects were identified, probable causes suggested, and where correction had been made, this was studied.

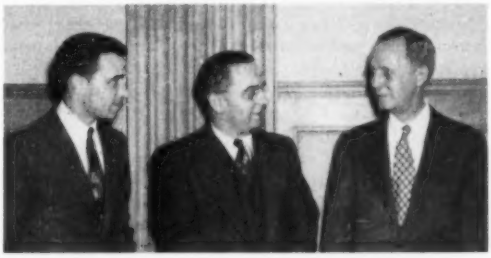
The four-evening sand school of the Southern California Chapter was arranged by E. K. Smith, consultant and chairman of the chapter's Educational Committee. He reports that combination of informal lecture and questions from the floor provided listeners with practical answers to foundry problems as well as bringing them up to date on new experimental work. Other educational activities of the Southern California Chapter include staging an essay contest for junior college students with participation by 11 schools, organizing a speaker's bureau to provide speakers for high schools and colleges, and acting in an advisory capacity on foundry and metallurgy courses in the colleges. Last fall the chapter, along with the local chapters of the American Society for Metals and the American Welding Society, sponsored a course in practical metallurgy of engineering metals and alloys at East Los Angeles Junior College.

Hold "How To Do It" Course

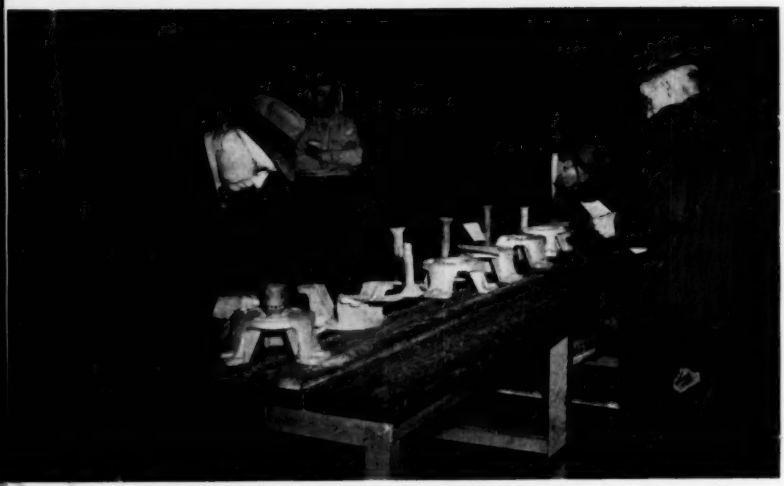
Chicago Chapter's educational course this year consisted of six "how to do it" sessions featuring discussions and demonstrations on sand testing, molding, coremaking, melting and pouring, cleaning of castings, and inspection. In charge of the course was George W. Anselman, Beloit Foundry Co., Beloit, Wis. Another Chicago Chapter educational activity during the past year has been the presentation of A.F.S. memberships to trade school foundry instructors.

An outstanding example of chapter-school cooperation is found in the relationship that has existed for a number of years between the Eastern Canada Chapter and the Montreal Technical School. The school is the center of activity each year for most of the chapter's educational work including the competition to pick entries in the Annual A.F.S. Apprentice Contest, according to Chapter Educational Chairman W. T. Shute, Canadian Car & Foundry Co., Longue Pointe, Que. The contests have been largely under the super-

Harold E. Henderson, H. C. Macaulay Foundry Co., Berkeley, Calif., announcing "School's out!" at the end of the sand school sponsored by the Northern California Chapter and Harry W. Dietert Co., Detroit. Photo is by Past National Director Samuel D. Russel, Phoenix Iron Works, Oakland. Below—Warren C. Jefferey, University of Alabama foundry instructor (left), Frank S. Brewster, Harry W. Dietert Co. (center), and Professor E. C. Wright, head of metallurgical engineering at Alabama, discuss the sand school put on with the cooperation of the Birmingham District Chapter, the university, and Dietert. Photographer was J. P. McClendon, Stockham Valves & Fittings, Birmingham, reporter and photographer for the chapter.



Below with Harry W. Dietert, Harry W. Dietert Co., Detroit (fourth from left) are Southern California Chapter leaders who posed for W. C. Baud, Food Machinery & Chemical Corp., Los Angeles, during the sand school held at the University of Southern California. Left to right are: E. K. Smith, consultant; Prof. James R. Cady, USC; Otto H. Rosentreter, projectionist; Mr. Dietert; Henry W. Howell, Howell Foundry Co., Los Nietos; Harold G. Pagenkopp, Angelus Pattern Works, Huntington Park; Leonard O. Hofstetter, Brumley-Donaldson Co.; and Earle D. Shomaker, Kay-Brunner Steel Products, Inc., Alhambra.



Judging St. Louis District Chapter entries in the 1950 A.F.S. Apprentice Contest at National Bearing Metals. Judges, left to right, are G. S. French, Semi-Steel Castings Co.; Clee Shy, Banner Iron Works (in foreground); and Francis O'Hare, O'Hare's Brass & Aluminum Foundry Co. In the background are two members of the Chapter Apprentice Committee, Norman Peukert, Carondelet Foundry Co., left, and Howard Shoults, National Bearing Metals.

vision of W. P. Sullivan, Warden King, Ltd., Montreal. In addition the school is the site of the chapter's lecture series put on primarily for students and apprentices, but attended heavily by foundrymen as well.

The school foundry can comfortably accommodate 25 students and has facilities for melting gray iron, bronze, steel, and aluminum alloys. Sand conditioning equipment, core ovens, and other customary foundry tools are available for production of castings on a small scale. Complete facilities for instruction in wood and metal patternmaking are also provided.

This year the Eastern Canada Chapter again held its technical papers contest with five entries who presented their papers in brief at the March chapter meeting. Some of these papers will appear in AMERICAN FOUNDRYMAN during the coming months. Two of the 1949 technical papers contest winners have already appeared in "The Foundrymen's *Own* Magazine," a third is in this issue (page 38), and a fourth will be published during the summer.

Miscellaneous activities of the Eastern Canada Chapter Educational Committee have included encouragement of plant visits and distribution of films and literature on a limited scale.

Give A.F.S. Libraries To Schools

Complete libraries of A.F.S. publications have been presented to the University of Chattanooga, University of Tennessee, and Vanderbilt University by the Tennessee Chapter as part of its educational program. Also recipients of A.F.S. libraries were the newest student chapters of the Society—Michigan State College and University of Alabama. Michigan State College, the eighth student group, was installed April 5. Alabama has been approved by the A.F.S. Board of Directors with installations scheduled for sometime later this year.

Repeating a program proved popular a year ago, the Rochester Chapter again put on its defective castings contest in April. For this program representative defects in carefully selected castings are displayed for identification, explanation, and suggested methods of correction. Everyone attending the meeting gets in on the competition and after papers are submitted and judged there follows a round table discussion on casting defects.

Regional conferences have long been an important part of the A.F.S. educational scheme. During the coming year there will be a new regional, to be sponsored by the Texas Chapter. Two more new regionals —St. Louis District and Northwest—are under discussion. The Texas Regional Foundry Conference will be held at the Plaza Hotel, San Antonio, October 5 and 6. Chairman is James R. Hewitt, Houston.

Deciding last year not to have full scale regional meetings every year such as were held in 1947 and 1948, the Eastern Canada and the Ontario Chapters start their every-other-year schedule with an All-Canadian Foundry Conference to be held in Hamilton, Ont., September 28-29. Murray N. Tallman, A. H. Tallman Bronze Co. Ltd., Hamilton—new Ontario Chapter chairman—is in charge with Chapter Vice-Chairman R. H. Williams, Canadian Westinghouse Co. Ltd., assisting. Meetings, all to be held at the Royal Connaught Hotel, include a three day sand lecture course and a variety of technical papers and discussions.

Preliminary plans announced for the Metals Casting Conference indicate the two-day meeting will again be held at Purdue University, West Lafayette, Ind., under the sponsorship of the university and the Michiana and Central Indiana Chapters. Dates are November 2 and 3.

Dates for the next Birmingham Regional Foundry Conference—February 22 and 23, 1951—were selected at the close of this year's conference. As usual the meeting will be held in the Tutwiler Hotel, Birmingham, Ala., and will include technical sessions and visits to some 25 plants in the area.

On dates not yet established, the Fourth Ohio Regional Foundry Conference will be held in Cleveland in the spring of 1951. Host chapter will be Northeastern Ohio with the other Ohio chapters of the American Foundrymen's Society—Cincinnati District, Toledo, Canton District, and Central—cooperating.

POLL SHOWS PRINCIPAL CAUSES FOR DEFECTIVE ALUMINUM SAND CASTINGS

W. E. Mahin
and
R. A. Lubker
Armour Research Foundation
Illinois Institute of Technology
Chicago

MOST ALUMINUM FOUNDRYMEN are familiar with the various defects which sometimes occur in aluminum sand castings. Much has been written on these defects and what to do about them. However, few data are available on the relative importance of the various problems.

To obtain some factual information on this situation, a nation-wide survey was carried out by the writers. Questionnaires were sent to foundries requesting the following information:

Please indicate approximate percentage of your total defectives that are attributed to causes shown:

___% Sand, dirt and inclusions	___% Blowholes and gas
___% Broken or cracked	___% Shrinkage and unsoundness
___% Core shift, molding defects	___% Cold shut, misrun
___% Warpage	___% Other

What is your approximate monthly production?_____lb
What is your approximate monthly defective loss?_____%
Approximately how many patterns run per month_____
Approximate average size of castings or size ranges___lb to ___lb
Comments_____

The replies to the questionnaire came in considerable number from all parts of the country, this despite the fact that considerable time was involved for each contributing foundry. The results were classified carefully and tabulated in three categories: (1) foundries producing from 3,000 to 30,000 lb of castings per month; (2) 30,000 to 250,000 lb per month; and (3) more than 250,000 lb per month. Results are given in Table I.

The tabulated information provides a basis for discussing some of the more important precautionary measures to be taken by the aluminum foundry in avoiding each of the basic types of defects reported in the survey. The significant factors for the various types of defects are discussed separately.

Organizing for Quality Control: Before considering the factors causing defects, the basic approach to any scrap reduction program should be recognized. A foundry defect may be compared to a human illness. Without medical research, fine doctors and modern hospitals, the U.S. mortality rate would not have made the actual phenomenal drop of the past three decades. Similarly, foundry defects yield to a combination of technical studies, shop quality control programs, and daily laboratory tests and controls.

No foundry can hope to attain a fine performance record in reducing scrap losses until it has taken four important steps, namely:

(1) Staffed itself with one or more competent quality control specialists.

(2) Provided the minimum essential laboratory testing facilities.

(3) Fitted the quality control staff effectively into the organization.

(4) Made all foundry personnel "quality control conscious" and pulling together against the common enemy—scrap.

Sand, Dirt, and Inclusions: Defects of this type were shown to be the worst offenders in medium-sized and large foundries, and the third worst offenders in small foundries. About one casting in every 35 reached the scrap pile as a result of such defects. In short, $3 from each $100 spent in the foundry for labor and overhead produced no salable product because of sand, dirt, and inclusion defects.

Foundries that are quality control conscious hold losses attributable to sand, dirt and inclusions to a minimum in the following ways: (1) Quality control specialists, superintendent, foremen and men are constantly watchful of mold cleanliness. If loose sand falls in the gate, the mold is opened and cleaned, or scraped before pouring. (2) Sands are controlled to a formula found satisfactory, and are frequently checked by laboratory tests. (3) In the handling of the molds and cores, care is emphasized along with speed and efficiency. (4) Molders are educated to use proper ramming procedures. (5) Attention is given to gating techniques to insure freedom from sand washing at this vital point.

Dross inclusions result from the metal and not from the molds. The dross floating on the melt should be carefully skimmed away, exposing a clean molten surface prior to dipping out metal or pouring. Of equal

TABLE I—SUMMARY OF SURVEY OF DEFECT LOSSES ENCOUNTERED BY ALUMINUM SAND FOUNDRIES

Nature of Defect	Small[1] Foundries	Medium Sized[2] Foundries	Large[3] Foundries	Average for all Foundries
Sand, dirt and inclusions	1.75	3.30	2.59	2.55
Blowholes and gas	3.50	1.75	1.03	2.09
Shrinkage and unsoundness	2.30	1.60	1.15	1.68
Cold shut, misrun	0.70	1.45	1.81	1.32
Core shift, molding defects	0.30	0.75	0.52	0.52
Broken or cracked	0.07	0.40	0.86	0.44
Warpage	0.10	0.05	0.21	0.12
Other	0.03	0.35	0.63	0.31
Total, %	8.75	9.65	8.80	9.06

[1]Average for foundries producing less than 30,000 lbs. of castings per month.
[2]Average for foundries producing 30,000-250,000 lbs. of castings per month.
[3]Average for foundries producing more than 250,000 lbs. of castings per month.

importance and of similar nature is the problem of avoiding excessive agitation or splashing.

In pouring, the lip of the ladle should be held as close to the gate as possible to minimize the fall of the metal. Pouring from a melting furnace into a crucible and then from the crucible into the mold is rather poor practice. Many of the oxide inclusions thus incurred can be eliminated if the metal is dipped from the melting vessel and poured directly. A good fluxing procedure is an essential part of the quality control program. Finally, gate design should be studied on each casting to encourage smooth metal flow.

The oxide envelope on molten aluminum is generally advantageous in that it prevents further oxidation and rapid pickup of hydrogen from the atmosphere. However, this dross may be trapped in the metal as a result of undue agitation during metal transfer, or

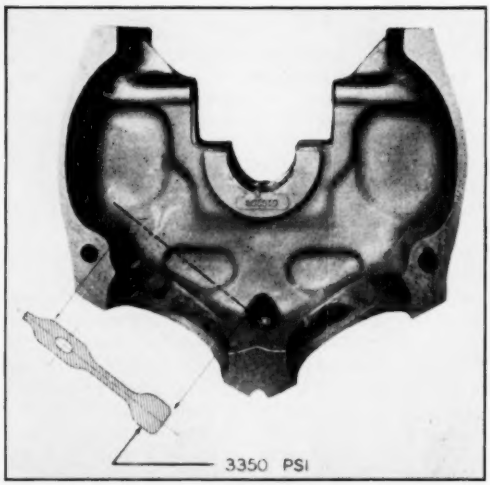


Fig. 1—Proper design is shown in the well-blended sections of this aluminum aircraft engine crankcase.

in the mold cavity itself during pouring. The specific gravities of aluminum alloys and aluminum oxide are so close that separation is difficult. Thus the oxidation problem is much more severe with aluminum than with the heavier metals which differ greatly in specific gravity from their oxides.

When melting scrap, both hydrogen absorption and dross formation are more severe than when melting pig metal, because of the larger surface-to-volume ratio. Therefore, foundry scrap should ideally be melted, ingoted, and remelted before being cast. However, it is generally more practical from an economic standpoint to treat the melt with a suitable grain refining flux. The average aluminum sand foundry charge probably contains one-third scrap.

Dross formation can be reduced to a great extent by fluxing with dry salt fluxes in accordance with the procedure described in the following section. Fluxing is a much more effective way of eliminating oxide inclusions than is ordinary skimming practice.

Blowholes and Gas: The poll results indicate that gas defects, the second worst troublemaker, predominate in small foundries, are less troublesome in medium-sized plants, and least in the large foundries. Yet average losses from all causes differ little in the three groups (Table I). This trend may well be the result of smaller foundries melting smaller pots of metal. Smaller melts mean faster heating and greater danger of gas pickup from overheating.

Most gas defects in aluminum castings result from release and entrapment of dissolved hydrogen during solidification. Hydrogen is the only common gas appreciably soluble in molten aluminum, and its solubility diminishes greatly during cooling. The amount dissolved at 1280 F is only one seventh as much as that at 1600 F. To assist in preventing gas defects, much can be accomplished by eliminating hydrogen at its source, e.g., oil-free dry melting stock should be used.

Aluminum ingot should always be stored in a dry place because hydrated aluminum oxide (a source of

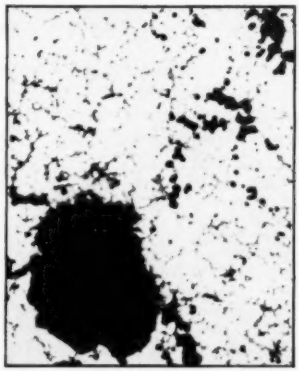


Fig. 2—Pinhole porosity grading into macroporosity is shown by this photomicrograph of an aluminum casting of composition Mg, 6; Mn, 1; and Cu, 1.5%. X50.

moisture in the melt) forms with high humidity. Ingots should be preheated for a few minutes above 250 F to eliminate moisture before charging.

Direct flame impingement on the metal surface during melting is another source of hydrogen. However, because of the impossibility of eliminating all sources of hydrogen (for example, moisture in the air), degassification is becoming a common treatment.

Advantage can be taken of the decreasing solubility at lower temperatures to remove hydrogen by slowly cooling the metal to the pasty condition, holding there for about 40-60 min and allowing it to freeze. The metal should then be reheated rapidly to the desired pouring temperature and cast. However, this technique is rather expensive and not always effective.

Hydrogen may be removed from molten aluminum by passing chlorine or nitrogen gas through the melt. These gases, which must be free from moisture to be effective, may be introduced into the metal by means of a small graphite tube with the open end at the bottom of the pot. Iron tubing may be used for nitrogen if coated with a refractory. The rate of gas flow should be just sufficient to give agitation without splattering.

The temperature should be about the same as that used for pouring the castings because reheating may result in further hydrogen pickup. Five to 10 min

treatment is generally sufficient for 250 lb of metal, although nitrogen does not seem to be completely effective if the melt is severely gassed. Chlorine should not be used with alloys containing magnesium except for the shortest chlorination period because the magnesium is removed as $MgCl_2$. *Chlorine always requires safe ventilation.*

The fluxing action of nitrogen is reported to be purely mechanical. Hydrogen diffuses into the nitrogen bubbles because of the lower partial pressure inside the bubbles, while dirt and oxide particles become attached and rise with the bubbles. In addition to this mechanical action, chlorine exerts a chemical effect, breaking up the oxide films, thus permitting easier outward diffusion of hydrogen. Any aluminum chloride formed is volatile and escapes into the air.

A popular method of degassing utilizes dry salt fluxes which become gaseous in molten aluminum. These should be placed in a perforated cup and held at the bottom of the melt. Stirring in the flux is not recommended because it means exposing fresh aluminum to the air. When the flux is held at the bottom the gases formed pass up through the metal, sweeping out the hydrogen and bringing the dirt and oxides to the top where they are readily skimmed off.

Dry salt fluxes are also very effective as a protective cover during melting. Since most salts are hygroscopic, they should be stored in a dry place to prevent moisture pickup. In addition to safety advantages, a minimum of equipment is required with dry salt fluxes.

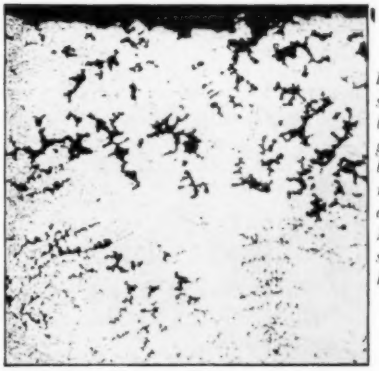
A further possible course of hydrogen is the moisture in green sand molds. Corrective measures are lighter ramming, more permeable sands, and as low moisture content as practicable. Contamination of the sand by clay balls, oxidized aluminum, and iron rust from the sand equipment also causes gaseous defects. The permeability of these materials is so low that moisture cannot penetrate them, and so explodes out against the solidifying metal to form a small void. Proper drying of cores and venting of molds are other important factors. Figure 2 illustrates typical gaseous porosity.

Shrinkage and Unsoundness: In the case of shrinkage and unsoundness, the smaller foundries again have the highest losses, and the largest foundries the lowest. It must be remembered that shrinkage always occurs when liquid aluminum freezes. However, the extent of shrinkage at a given point—the location of greatest shrinkage—is controllable. The "tools" of this control are: (1) location, number and size of gates; (2) location and especially size of risers with respect to design of the casting; and (3) pouring temperature.

The "tools" are indeed well known; the question is, are they applied carefully and effectively? Here it is believed that the larger foundries have the advantage; they have the longer runs, more permanent patterns, and a greater ability to add the cost of quality control personnel to the foundry overhead.

Gating and risering problems are not for the novice. Each casting requires individual treatment. Design of gates and risers must take into account natural laws governing heat flow and directional solidification.

Basically, shrinkage cavities indicate lack of progressive solidification. This results from design limitations of the casting or failure to provide proper feeding through use of risers. A suitable combination of risers, chills and change of gating is often necessary to provide the proper temperature distribution and obtain directional solidification. Redesign of the casting may be necessary.



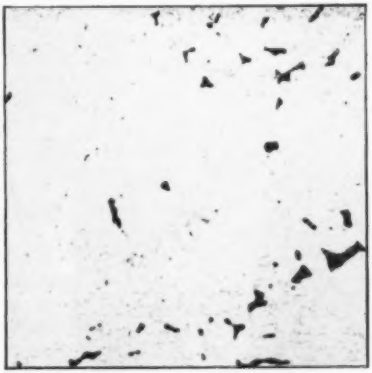


Fig. 3—Left—Typical spongy shrinkage adjacent to and just below the casting surface, and grading into microshrinkage below, is shown in this photomicrograph of an aluminum alloy casting. X8. Right—Microshrinkage in the same specimen (left) is shown at higher magnification. X50.

Surface shrinkage and large grain size often indicate excessive pouring temperature, or excessive time at a lower temperature such as is experienced with remelting scrap several times. This may be merely lack of pouring temperature measurement and control. If so, again look to the quality control system.

Surface shrinkage also may be caused by hard ramming, with reduced mold conductivity to hot spots at heavier sections. Surface shrinkage on cored castings sometimes results from core shift and the resulting uneven wall thickness. Shrinkage at the gate of thin castings may be eliminated by a small riser in the runner outside of the gate.

Figure 3 shows typical spongy shrinkage adjacent to and just below the surface and grading into microshrinkage below. Figure 4 illustrates shrinkage in gassed metal. Radiographs showing shrinkage defects are shown in Fig. 5.

Cold Shuts and Misruns: Increasing losses due to cold shuts and misruns in the larger foundries are somewhat difficult to explain. Cold shuts and misruns are cold metal defects—the metal became cold before the

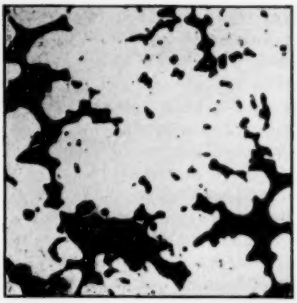


Fig. 4—Microshrinkage in this aluminum alloy specimen is due to gassed metal. X50.

Fig. 5A—Radiograph shows localized, spongy-type shrinkage in the upper portion of 3-in. thick section of an inadequately fed aluminum alloy casting.

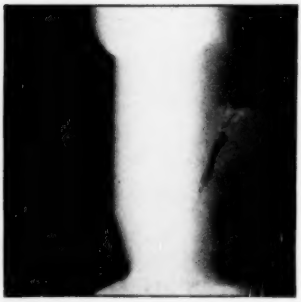


Fig. 5B—Surface shrinkage of a fillet in an inadequately fed aluminum alloy casting is shown in this radiograph.

mold was completely filled. This generally means thin sections. Thin-sectioned castings are most common in high production runs, which in turn are more prevalent in large foundries. Also, it seems to be the tendency for smaller foundries to pour hotter metal than the larger foundries.

One large foundry is known to have set up a new high production pattern at ten molding stations and produced 25 to 50 per cent defectives for several days before bringing the job under control. At that time, this particular foundry was learning the need for an adequate quality control program.

Actually, high production runs give the quality control group an easier problem than a large number of short runs. In long runs, statistical analysis may be applied to a study of pouring temperature.

Using the statistical method, an hour's run at each of successively higher start and finish pouring temperatures may be plotted against percentage of rejects for cold shut and misrun. If excessive pouring temperature is required to reduce losses to an acceptable minimum, then the gating is brought under study. Filling the mold faster at the same "finish pour" temperature may be compared with the old gating in the same pattern from an adjacent machine.

Alloy composition has a great effect on fluidity of the metal—the lower-melting alloys having the least tendency to cold shut and misrun. Of course, there are other considerations in the selection of alloys.

The final "tool" available is to increase the number of gates so that the metal flows a shorter distance through thin sections. Once experimentation shows the way, the quality control group continues to keep an eye on production.

Other Defects: Relatively minor defects disclosed by the survey include core shift, molding defects, broken or cracked castings, and warpage. Probably a major cause of these defects is careless workmanship. Unfortunately, this seems to be characteristic of the times. Some industries and some plants seem to suffer more than others, indicating that careful hiring, proper training of new personnel, and good personnel relations can help.

Technical causes should not be overlooked. For example, core shifts are not necessarily caused by the molder omitting the chaplet. A common cause is hot metal impingement due to improper gating in conjunction with oversized core prints. Hot tears may result from faulty casting design or the use of high strength cores. The aluminum-silicon alloys are less susceptible to hot tears than aluminum-copper alloys, and proper gating is important.

Warpage may result from too early or careless shakeout. Improper thermal gradients during solidification also cause warpage, and it then becomes a design and gating problem.

Eliminating Defectives Through Process Control: Transmission of information to the worker is of the greatest importance in any control system, and a process card on each casting is one of the essential methods.

The process or casting card should give brief instructions on all of the important variables and list numerical limits wherever possible. The alloy and sands to be used should be specified, as well as important special factors in the melting and sand-conditioning operations. Molding, gating, and risering should be described with sketches. All tests to be made should be specified, and limits listed, for variables such as sand moisture content, green compression strength, mold hardness, tensile strength of test bars, etc.

The process card should be attached to the order card which is sent to the shop. It is prepared by the control group or engineering department and approved by the production department.

Probably the best control card system limits the information on the individual casting card to those items which are special for the casting covered by the card. For example, if only one type of sand is used, then sand control is not covered by the card. Rather, the person or persons responsible for mixing the sand should receive separate special instructions in the form of a process specification.

Acknowledgment

The material for this article was procured from a survey sponsored by the U. S. Reduction Co., East Chicago, Ind. The survey results were published in the company's *News-Casting*.

Foundry Organizations Elect Officers At A. F. S. Convention

ELECTION OF OFFICERS of two over-all foundry organizations—the National Castings Council and the Foundry Educational Foundation—were held at this year's A.F.S. Foundry Congress and Show.

New head of the National Castings Council is E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md., who is completing a year as president of the American Foundrymen's Society. Other officers are: *vice-president*—Thomas H. Shartle, Texas Electric Steel Casting Co., Houston, Tex., president, Steel Founders' Society; *secretary*—Frank G. Steinebach, Penton Publishing Co., Cleveland; and *treasurer*—F. Ray Fleig, Smith Facing & Supply Co., Cleveland, representing the Foundry Facing Manufacturers' Group.

Made up of the president and a member of the board of directors of eight organizations serving the foundry industry, NCC grew out of a meeting held during the 1946 A.F.S. Convention.

New FEF Officers and Trustees

Elected president of the Foundry Educational Foundation at the 1950 A.F.S. Convention, Claude B. Schneible, Claude B. Schneible Co., Detroit, appointed a Steering Committee to meet more often than the usual three meetings per year held by the trustees of the organization. On the newly formed committee are the three FEF past presidents—Anthony Haswell, Dayton Malleable Iron Co., Dayton, Ohio, Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio, and Stowell C. Wasson, National Malleable & Steel Castings Co., Chicago—plus Mr. Schneible, John M. Price, Ferro Machine & Foundry Co., Cleveland, and George K. Dreher, executive director. A Steering Committee member, accompanied by one or more officers or trustees, is expected to visit each of the 12 FEF schools during the coming year to assist in maintaining school-industry liaison.

Placement of engineering graduates and undergraduate summer workers exceeds placements in any previous year with more companies participating than before, according to Executive Director Dreher.

Foundry Educational Foundation officers for the coming year are: *chairman of the board*—Mr. Wasson, immediate past president of FEF; *president*—Mr. Schneible; *vice-president*—C. R. Culling, Carondelet Foundry Co., St. Louis; *secretary-treasurer*—Charles A. Barnett, Foundry Equipment Co., Cleveland, who continues in office along with Mr. Dreher.

Trustees representing the various founding members of the Foundation for the coming year are: Malleable Founders' Society—Mr. Haswell, former president and chairman of the board of FEF; and Collins L. Carter, Albion Malleable Iron Co., Albion, Mich.; Gray Iron Founders' Society—Mr. Price, former board chairman and president, and Mr. Rentschler; American Foundrymen's Society—Mr. Wasson, and Fred G. Sefing, International Nickel Co., New York; Foundry Equipment Manufacturers' Association—Mr. Barnett, and Mr. Schneible; Non-Ferrous Founders' Society—George B. Hazen, Brass Foundry Co., Peoria, Ill., and Arthur L. Fischer, Fischer Casting Co., North Plainfield, N. J.; Steel Founders' Society—T. F. Dorsey, Fort Pitt Steel Casting Co., McKeesport, Pa., and Homer Tielke, Crucible Steel Casting Co., Inc.

E. W. Horlebein

Claude B. Schneible

Trustees-at-large for FEF are: Jas. H. Smith, Central Foundry Div., General Motors Corp., Saginaw, Mich.; B. D. Claffey, Acme Aluminum Alloys, Dayton, Ohio, former FEF vice-president; Mr. Culling; James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; George J. Behrendt, Eastern Malleable Iron Co., Naugatuck, Conn.; M. J. Allen, American Steel Foundries, Chicago; Frank C. Riecks, Ford Motor Co., Dearborn, Mich.; and Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Past presidents of the Wisconsin Chapter of A.F.S. pose at the A.F.S. Foundry Congress each year for a group photograph. Of those present this year, seven met at the FEF booth. Sitting, left to right, are: Walter Gerlinger, Walter Gerlinger, Inc., Milwaukee; W. J. MacNeill, Dayton Malleable Iron Co., Dayton, Ohio; and B. D. Claffey, Acme Aluminum Alloys, Dayton, Ohio. Standing are: George K. Dreher, FEF; Harry E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee; John Bing, Metropolitan Refractories Corp., New York; and D. C. Zuege, Sivyer Steel Casting Co., Milwaukee.

Questions THE ROUND TABLE Answers

When Do Graphite Nodules Form?

Do the balls of graphite in nodular iron form from the liquid metal, during the mushy stage, just after solidification, or when?

There's been a lot of speculation on this but little conclusive data. Recently we've heard three reliable investigators state: (1) Nuclei of the nodules are present in the liquid state; (2) The first step in solidification of the eutectic is the formation of nodules; (3) Nodules form from the liquid metal. A fourth says the nodules form around some sort of magnesium carbide nuclei but that we won't get anywhere on mechanism of nodule formation until we revise the iron-carbon-silicon equilibrium diagram! A number of foundrymen feel the industry will progress faster in the study and the development to maximum usefulness of nodular iron if they understand how the nodules are formed. Foundrymen are invited to comment for publication on the mechanism of nodule formation.

Diatoms Started It

What is diatomaceous earth which is the basic ingredient of the insulating sleeves and pads described by Edward D. Boyle, in his paper, "*Promoting Riser Fluidity*," which appeared in *American Foundryman* (February, 1949, page 45)?

Diatomaceous earth (familiar to some foundrymen as kieselguhr) is made up of the siliceous skeletons of diatoms, microscopic algae which occur widely in fresh and salt water, in soil, and as fossils. Diatoms are most abundant in cold latitudes, having a general preference for cold water, and exist in prodigious numbers in the Arctic and Antarctic Oceans.

Large numbers of fossil diatoms are known. The siliceous wall is practically imperishable and persists after the death of the diatom. Where diatoms occur abundantly, there is an unceasing hail of their minute skeletons on the bottom of the body of water. Thus, extensive deposits of diatomaceous earth develop and they are not only being formed at present, but have been produced abundantly in the past.

Deposits of diatomaceous earth have been discovered in various parts of the earth, most being a few feet in thickness, some occurring much thicker. Thickest deposits thus far discovered are in the Santa Maria oil fields of California. Largest commercial areas in the United States are in California and Oregon where the deposits are worked as open quarries.

Diatomaceous earth is one of the best insulating materials known. It has a high sintering point, tests at Puget Sound Naval Shipyard having shown as high as 2300 F for commercial diatomite previously sintered for insulation in boiler work. We have obtained our best results in using the commercial sintered diatomaceous earth. This material is used in both the insulating sleeves and in powdered form sprinkled over the risers to retain the heat.

Results of our recent experiments with a new mold insulating material will be reported in an early issue AMERICAN FOUNDRYMAN.

EDWARD D. BOYLE, *Master Molder*
Puget Sound Naval Shipyard
Bremerton, Wash.

Where The Metal Goes

We run a jobbing foundry and produce about 200 tons of low carbon steel castings a month, melting with a 1½ ton direct arc furnace. For comparison with our practice can you give a typical breakdown of metal going into gates and risers, melting loss, good castings, and scrap?

Specific figures depend a great deal on composition, size, section thickness of castings poured, and type of scrap, but the following percentages based on weight of metal charged will be useful as a guide: melting loss, 6 per cent (lower with bulky, clean scrap); unaccounted for (spills, grinding losses, etc.), 1½ per cent; defectives, 2½ per cent; gates and risers, 38 per cent; good castings, 52 per cent.

Takes More Than Aluminum Powder

Is it true that aluminum powder can be used to maintain risers on steel castings in a molten condition?

The material you are referring to is not aluminum alone but a mixture of aluminum and iron oxide. When the mixture is heated, such as when it is put on a riser, the two components react to form molten iron and a slag which is predominantly aluminum oxide. In reacting, the mixture develops a considerable quantity of heat which keeps the riser molten while the newly formed metal (about half the original mixture by weight) helps feed the casting. Other oxides such as nickel, copper, or chromium oxide can be used with powdered or granulated aluminum, the choice being governed by the alloy cast.

A safe method of ignition of a mixture of aluminum powder and iron oxide was discovered by Goldschmidt in 1895. Thermit, as the mixture is called, is used in welding heavy sections and an interesting picture story on the practice appeared in AMERICAN FOUNDRYMAN, July 1949, page 42. During the war the Naval Research Laboratory developed the use of thermit for the production of small steel castings for use where customary production facilities were not available. A variety of exothermic mixtures for risers is on the market.

Flake Graphite Has Been Classified

In a recent paper on gray iron the author referred to Type A graphite. We should be glad to receive more information about this.

Classification of graphite type, size and distribution is covered by A.S.T.M. Standard A 247-47, an outgrowth of the work of a joint A.F.A.-A.S.T.M. committee which in 1941 offered a tentative recommended practice for evaluating gray iron graphite microstructures for consideration at the 1941 annual meeting of the American Society for Testing Materials. Adopted as a standard in 1947, the recommended practice is not to be construed as a specification but merely as a standard method for describing the occurrence of graphite in the microstructure of cast iron.

Interest in graphite classification has been evident for many years prior to the formulation of the now standard procedure. Papers presented before the then A.F.A., and before A.S.T.M. and foreign technical groups crystallized the foundry industry's thinking and led to the first classification by Armour Research Foundation's W. E. Mahin (then with Westinghouse).

Under current practice, graphite size is graded 1 through 8 depending on the average flake length seen in a representative specimen at 100 diameters. Length diminishes from Size 1 (longest flakes at X100 four inches or longer) to Size 8 (longest flakes 1/16 in. or less).

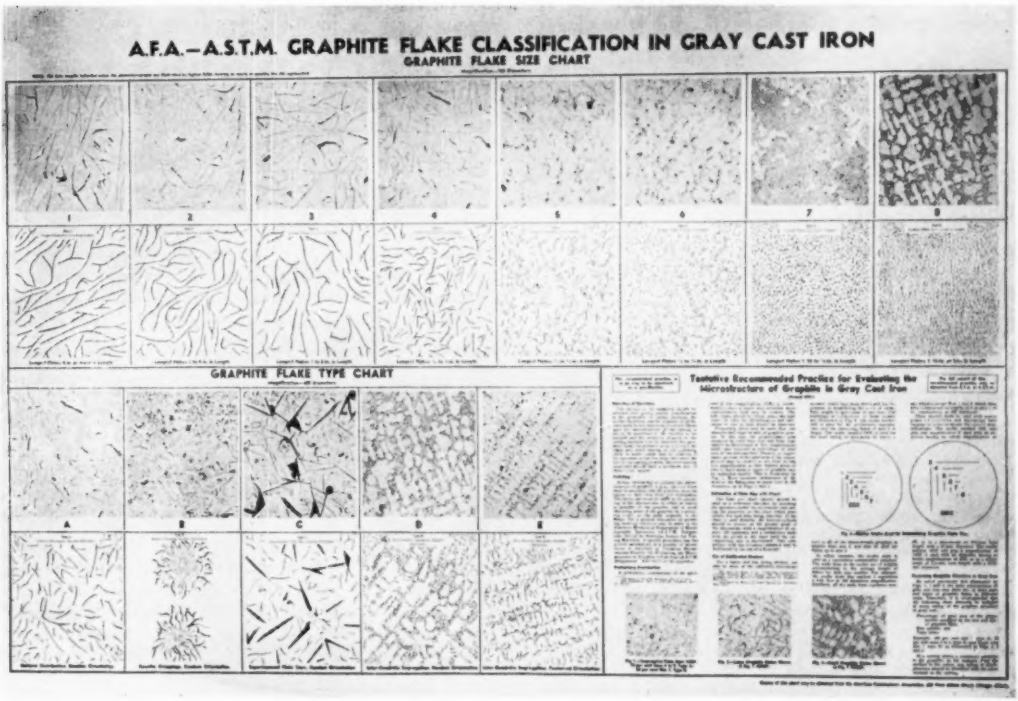
Graphite types are designated as: Type A—uniform distribution, random orientation; Type B—rosette groupings, random orientation; Type C—superimposed flake sizes, random orientation; Type D—interdendritic segregation, random orientation; Type E—inter-dendritic segregation, preferred orientation.

The graphite flake classification chart reproduced in miniature below appears full size in the CAST METALS HANDBOOK and in A.S.T.M. Standard A 247-47 with each photomicrograph and idealized diagram 4 in. x 4 in.

In using the chart, the metallurgist selects a representative sample giving due consideration to section thickness, presence of chills, and proximity of casting surfaces. Polishing with care to avoid removal of flakes or obscuring them by metal flow, he makes a preliminary examination at low magnification, say X25.

Size estimation can be made by throwing microstructures on a ground glass at exactly 100 diameters for comparison with the chart or by use of the faster and less tiring calibrated microscope ocular.

Composite graphite flake size and shape classification chart.


A.F.A.—A.S.T.M. GRAPHITE FLAKE CLASSIFICATION IN GRAY CAST IRON
GRAPHITE FLAKE SIZE CHART
GRAPHITE FLAKE TYPE CHART
Tentative Recommended Practice for Evaluating the Microstructure of Graphite in Gray Cast Iron

CORE OIL EVALUATION METHOD

R. H. Olmsted
Whitehead Bros.
New York

PROPER SELECTION OF CORE OILS is often neglected in many foundries. It is common to find foundries which have been using certain core oils for long periods with no actual thought or knowledge about what oil, or even type of oil is best suited for their particular class of work.

The oil in use is often a carry-over from earlier days when factors such as the man in charge, mulling and baking equipment, and type of cores were different from the present practice. In other typical cases it is assumed that a certain oil is ideal for all types of work and all conditions simply because another foundry happens to be using it with success. The oil being used may appear to be satisfactory under certain conditions, when in fact it may be far from the ideal material for the particular work involved.

This article is a direct result of the experiences of the writer with one of these so-called "typical cases." For many years a high priced core oil had been used with good results when, strictly by chance, it became apparent that the economic factor had been ignored.

A core oil supplier asked permission to furnish the foundry with a sample of a lower priced oil which was felt to be suitable for the particular application. Permission was granted, tests were run, and in actual production it was found that comparable results could be obtained under similar conditions, with large savings in the original cost of the material. This naturally created much interest in the matter and it was decided that a more thorough investigation be made in order to determine just which core oil would be the most satisfactory when all aspects had been considered.

Five reputable core oil companies were invited to furnish oils which they felt would be most suitable for the conditions existing within the foundry. Twelve oils were obtained from these five suppliers after each had studied the foundry applications.

Preliminary test cores were baked in a large stationary oven along with a regular run of production cores, and it was found impossible to control the time and temperature cycle to the necessary degree of accuracy. It was also decided at this time that the regular core production schedule could not be disrupted in order to run the test cores separately. Also, the cost of operating such a large oven for the tests alone was prohibitive.

A laboratory oven, suitable for unlimited types of research and experimental work, was purchased. It was necessary to run several more preliminary tests in order to determine the proper settings of the oven controls for the desired cycles. Many foundries have a relatively small oven which can be used to good advantage for any similar comparison of core oils, thus avoiding the cost of a special unit.

The sand used in the evaluation was a washed and dried New Jersey silica sand. A typical screen analysis is shown in Table 1. Although the sand was uniform when purchased and stored, the fact that it was dry made it difficult to get uniform samples from the large storage bins as needed for the evaluation tests. As a solution to this problem a large sand hopper was filled with about 2 tons of the uniform material, and this supply proved to be sufficient for all tests and satisfactory in all other respects.

After further preliminary tests, the mixture finally decided upon for all comparative tests consisted of 30 lb of sand, 4 fluid oz of core oil at 70 F, and 16 fluid oz of water. Tap water was used to obtain actual production conditions. The core oil ratio selected gave the baked properties desired for best comparisons. Other ratios were tried, but were not satisfactory. Cereals, etc., were not used in the test mixtures because it was

TABLE 1—TYPICAL SCREEN ANALYSIS OF WASHED AND DRIED NEW JERSEY SILICA SAND USED IN THE CORE OIL EVALUATION TESTS.

Mesh	% Retained	Mesh	% Retained
6	—	70	33.7
12	—	100	39.1
20	0.1	140	13.8
30	0.3	200	2.7
40	1.5	270	0.4
50	8.3	Pan	0.1

TABLE 2—TYPICAL DATA FROM THE CORE OIL TESTS

Core Oil	A	B	C	D	E	F	G	H	I	J	K	L	A	A
Amount of Oil, fluid oz	4	4	4	4	4	4	4	4	4	4	4	4	3½	3
Amount of Sand, lb	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Water, fluid oz	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Moisture, %	3.4	3.3	3.4	3.4	3.3	3.2	3.4	3.4	3.3	3.4	3.4	3.4	3.3	3.2
Green Wt., 2x2-in. spec., grams	159	159	159	159	160	159	159	159	158	158	160	155	159	159
Green Permeability	105	105	105	105	105	112	108	108	115	115	102	126	105	108
Baked Permeability	122	119	119	119	119	126	122	122	126	126	119	142	119	126
Baked Wt., 2x2-in. spec., grams	153.8	154.0	154.0	154.0	154.0	153.7	153.5	153.8	152.6	152.5	155.0	150.0	154.0	153.6
Baked Shear Strength, psi														
1 hr at 400F	63	58	57	54	35	31	33	54	27	35	51	19	44	29
1½ hr at 400F	70	59	55	57	30	32	29	52	26	36	49	20	43	30
2 hr at 400F	67	50	56	54	34	34	29	51	25	32	49	18	45	30
Baked Compression Strength, psi	93.5+	93.5+	93.5+	93.5+	93.5+	92	91	93.5+	78	93	93.5+	59	93.5+	89

NOTES:
Baking temperature, 400F.
Total mulling time, 6 min.
Tensile strength and transverse strength test results were too low for accurate comparisons.

considered that in a strict core oil evaluation all possible variables should be eliminated.

After all comparative tests had been run the final choice of the oils was tested in smaller quantities than the 4 fluid oz to determine if the desired results could be obtained with a lesser amount of the new oil in relation to the oil used previous to the investigation. Typical data on all oils, mixtures, and tests appear in Table 2.

Mixtures were made in a batch type laboratory muller, but any mixer which is properly maintained can be used. A small core sand mixer in which batches as small as 25 lb can be mulled is ideal. Several changes in mulling, largely of a maintenance nature, were necessary before the best results were obtained.

The mulling cycle finally decided upon was as follows: mull 1 min dry; add oil, mull 2 min; add water,

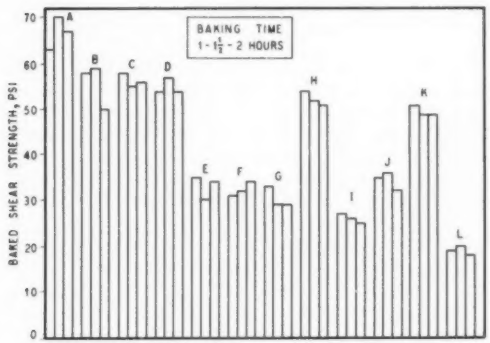


Fig. 1—Comparisons of baked shear strengths of various core oil test specimens baked at 400 F. The first column of each group represents a baking time of 1 hr; the second column 1½ hr; and the third column 2 hr.

and mull 3 min, a total of 6 min. Variations in this cycle can be made but this particular cycle worked best in this instance. The addition of the oil before the water gave good results, and the mixing was thorough and uniform as evidenced under a "black light."

After the first few comparisons of the various oils, it was found that all green tests and the dry weight and permeability tests were quite similar regardless of the oil used. At the same time the baked tensile and transverse tests were found too sensitive to be of any value. This left only the baked shear and baked compression tests for comparing the baked properties of the different oils. The baked compression test gave some valuable relative comparisons, but it could not be used satisfactorily for evaluating the oils as many of the test cores would not break within the working range of the testing machine.

The baked shear strength test was chosen as the basis for evaluating the baked properties of the various core oils. This test gave excellent comparisons, due chiefly to the ease and accuracy of duplicating results. A block core was used at different times as a check on the thoroughness of baking, but it was not of much value.

The baking temperature found to give the best comparisons was 400 F. Similarly, the most suitable baking times were 1, 1½, and 2 hr.

A general summary of the pertinent information and considerations which entered into this investigation follows:

1. Of the rather complete chemical information obtained for all the oils, only the saponification numbers and flash and fire points were of actual value in this particular case. The oils with the largest figures for these tests seemed to be the most resistant to overbaking.

2. The baked (dry) shear strength tests gave the most information of all the physical tests. Several oils were quite similar on this particular count, but only one was outstanding when they were compared on an over-all basis under the existing test conditions.

3. It was found extremely important that sand mullers be kept in top condition in order to obtain full benefit from the ingredients and full efficiency and peak production from the equipment. The best raw materials and mixture ratios will be of little significance if the mixing equipment is neglected. The need for cleaning and adjusting, as recommended by the manufacturers, cannot be emphasized too strongly.

4. Because of the wide variations in price, chemical properties, and physical properties, it was felt that a conclusive final choice of a core oil could be based on the relative cost per pound of baked shear strength developed. One oil ranked first in this respect as it had in practically all other points, although four other oils ranked quite favorably on this particular cost versus strength basis.

5. The original oil, which had been used for a long period, was found to rank quite low among the 12 oils tested. Practically all of the other oils were found to cost less than this original product, and they gave as good or better results when used in the same quantities and under the same conditions. On the relative cost per unit of baked shear strength, the figure for the original oil was more than twice that of five other oils. Mixtures with various percentages of core oil were included in the evaluation tests.

6. Of the 12 oils tested six were classed as light in color and six were of the dark type. A dark color usually indicates that the oil is basically a mineral

TABLE 3—EVALUATION SUMMARY OF 12 CORE OILS.

Core Oil	Color	Best Baking Time, hr (400F)	Max. Baked Shear Strength, psi	Oil Cost/lb Baked Shear Strength*
A	Light	1½	66	100
B	Light	1½	59	105
C	Dark	1	58	103
D	Dark	1½	57	105
E	Light	1**	40	199
F	Light	2	34	230
G	Light	1	33	216
H	Dark	1	54	107
I	Dark	1	27	198
J	Dark	1½	36	110
K	Light	1	51	127
L	Dark	1½	20	288

* Core oil "A" is used as the standard with 100 as the basis of comparison, e.g., if "A" costs $0.0100 per lb of baked shear strength, "C" would cost $0.0103, and "I" would cost $0.0198.
** Baking temperature 450F.

polymer, while light colored oils are considered to have a vegetable base, usually linseed in the better grades. Relatively new, the polymer type dark oils have proved superior to the oxidizing type light oils for certain applications.

Probably the outstanding feature of the dark polymer oils is the speed at which they bake. During the baking cycle any oil must first oxidize and then polymerize and, since the polymer oils have already been oxidized to a great extent, they bake much more rapidly than do the oxidizing oils such as the linseed-base types. Where oil sand cores are well segregated as to size and oil content and baked accordingly, the polymer oils can be used to great advantage, but where all cores are given the same baking cycle the oxidizing oils are superior in that they have more resistance to overbaking and burning.

Since it was impossible to segregate cores in this particular case where an oil-fired stationary batch oven was used, this fact was considered when one of the oxidizing oils was chosen instead of one of the very good polymers. The fact that cores ranged in size from one to 1,000 lb with no segregation certainly emphasized the need for an oil which would be resistant to overbaking and burning. The smaller cores are shielded to some extent, and many of the larger cores are not solid sand, having vents, fillers, etc.

Core Oil Selection Factors

7. Core oil "A" was found to be the best of the 12 products tested and compared under the conditions as they existed in this particular case. Some of the outstanding characteristics of "A" are:

a. "A" gave the best baked properties of all the oils tested (Fig. 1, Tables 2 and 3).

b. Oil "A" had one of the highest saponification numbers and flash and fire points. These high values might aid in explaining why "A" gave more consistent baked properties and offered such resistance to overbaking even at relatively high temperatures for long baking cycles.

c. "A" was the most consistent and uniform oil tested when subjected to oven conditions conducive to overbaking. Other oils lost strength rapidly when baked at 450 F for any typical time. Although "A" also lost strength, it still maintained its superiority. In fact, preliminary experiments indicated that the 450 F tests would not be of any particular use in the actual evaluation because of the rapid loss of strength in all cases.

The 400 F baking temperature was found to be the best; 425 F is the maximum which gives relatively full benefit from any of the core oils.

d. Oil "A" gave the lowest relative cost per pound of baked shear strength. Four other oils ("B", "C", "D", and "H") compared quite favorably with "A" on this count, but the many other superior properties of "A" removed any doubt as to which oil should be chosen for the particular conditions involved. Further details on this phase of the investigation are shown in Table 3 and Fig. 2.

8. Similar results could be obtained by using as much as 25 per cent less of the "A" oil in comparison with the original "F" oil. An indication of this may be seen in the last two columns of Table 2 where only 3½ and 3 fluid oz, respectively, of "A" were used in comparison with the standard 4 fluid oz of "F". Varying ratios of the other oils showed the same trend.

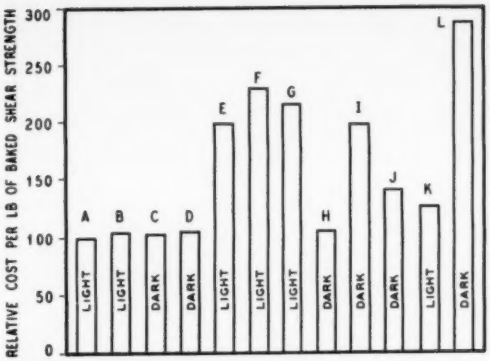


Fig. 2—Relative core oil costs are graphed on the basis of cost per pound of baked shear strength developed.

Although the purpose of the investigation was to find the best core oil available for the type of work involved regardless of the original cost of the raw material, it was significant that in addition to its other advantages oil "A" was less expensive than the oil formerly used.

Some of the important factors concerning the regular production setup of any foundry undertaking an evaluation of core oils are as follows:

Are the core ovens of the stationary batch, tower conveyor, or horizontal conveyor type?

Is gas, coal, oil, or electricity used as oven fuel?

Can the baking temperatures and time cycles be controlled accurately?

Is it possible to control core production schedules in order to bake the cores under the most ideal conditions? Ideal conditions would include baking at a minimum temperature for a minimum time. Under such conditions it would be possible to obtain maximum production with minimum fuel consumption.

Is segregation practicable?

Is the mixing equipment given proper maintenance?

A.F.S. Library Receives Rare Volume

Gift of Mario Olivo, president of the Italian Foundrymen's Society, to the A.F.S. Library is an extremely rare and valuable volume of *"De La Pirotechnia,"* written by Vannocio Biringuccio of Siena, Italy, and published early in the Seventeenth Century. The volume was brought to this country by Robert Doat of Belgium, who presented it to the Society at the 54th A.F.S. Foundry Congress & Show.

Bound in old parchment, this rare volume is the first known work in which the art of casting metals is described in detail and is written by one of the greatest masters of the foundry art of all time, Vannocio Biringuccio, head of the Papal Foundry in Rome and known as the "father of the foundry industry." Mr. Olivo's gift was made with the wish that it will serve as a nucleus in developing the A.F.S. Library as the world's finest collection of foundry works.

FOUNDRY SAFETY PROGRESS AND ACHIEVEMENTS REPORTED BY PHILADELPHIA CHAPTER MEMBERS

PUTTING INTO ACTION A.F.S. interest in promotion of safety in foundries, the Philadelphia Chapter took part in the 16th Annual Philadelphia Regional Safety Conference and Exhibit March 8. The two-hour program, in the form of a panel discussion, covered four subjects: (1) "Participation—The Keystone of Accident Prevention," (2) "Personal Protection Equipment—Who Buys It?", (3) "Now It's Happened—What are You Going to Do About It?", and (4) "Prevention of Major Accidents by Control of Minor Accidents."

The session was opened by Chapter Chairman William Morley, Olney Foundry Div., Link-Belt Co., who welcomed the group on behalf of the Society and Chapter, emphasizing the Society's interest in foundry safety.

John C. Bonnell, U. S. Pipe & Foundry Co., Burlington, N. J., arranger and leader of the discussion, established the theme of the meeting by citing records showing that one foundry worker in 19 will experience a disabling injury in 1950. This does not have to happen, he said, if recognized breeders of accidents—improper attitudes, chance taking, and unsafe conditions—are controlled.

Eugene Bender, American Mutual Liability Insurance Co., explained that the greater the participation of employees in a plant safety program the better the accident record. This can be achieved through education and instruction, not by forcing regulation. We can call participation the pendulum of accident prevention, he declared, with the company president initiating safety at the top, and the swing of the pendulum the area of the action throughout the plant. Spreading the gospel of safety takes much time and patience of all concerned, he added.

Arnold N. Kraft, Wilkening Mfg. Co., reported that his company has established a new national safety record for foundry and machine shop combined of well over three million hours. His company lays particular stress on the importance of setting up and maintaining an effective program for the purchase of personal protection equipment. This is accomplished by a study of each operation by the safety supervisor, foreman, and worker, Mr. Kraft said. Set rules and disciplinary measures are then established after the equipment is secured.

E. D. Morgan, Bethlehem Steel Co., Bethlehem, Pa., discussed the importance of controlling minor accidents in order to prevent major accidents. Safety at Bethlehem is an integrated part of all operations and when accidents occur they are interpreted as a symptom of something wrong with training, supervision, or the worker's approach to the job, he stated.

Regardless of the cause, an accident is considered an indication of some inefficiency in the operation, and everyone involved is deeply concerned with preventing its re-occurrence. The company made an investigation of all so-called minor accidents which had an apparent serious potential. These have been named Near Lost Time Accidents and are given the same critical attention previously given only to major accidents. Analysis of these accidents demonstrated the need for a more personalized approach.

Bethlehem Steel asked each foreman to analyze the jobs under his supervision from the safety angle. Supervisors regularly and frequently review with the worker the safety practice of his individual job and a record is kept by the safety engineer of the time of the interviews. Bethlehem's frequency rate has been reduced to a record low of 0.84, said Mr. Morgan.

Wilmington Plant of the Eastern Malleable Iron Co. has an enviable safety record and William H. Cantwell ascribed some of it to attention to past accidents. Accurate information developed from careful investigation, he declared, leads the company to classify accidents as being due, in the main, to mechanical causes, such as unguarded equipment and defective machinery; due to physiological causes, such as overfatigue and nervous strain; and due to mental causes, such as inexperience, carelessness, emotional disturbances, and ignorance. Proper analysis of an accident will determine its cause and suggest a remedy, said Mr. Cantwell, in placing responsibility for overcoming accidents squarely in management's hands.

Ohio Foundry Beats Own Record

Surpassing their previous all-time record of 225 days without a lost-time accident on March 22, employees of the Hamilton Foundry & Machine Co., Hamilton, Ohio, are going all-out to establish a safety record that will stand for years to come. Largely responsible for this fine showing are members of the company's Workmen's Safety Committee, shown in this photograph. Also pictured are Plant Nurse Irene Sackenheim; Personnel and Safety Director Eldon Altman (third from left) and Company President Peter E. Rentschler and Vice-President Donald McDaniel, standing second from right and at right.

Abstracts of Technical Literature

Abstracts below have been prepared by Research Information Service of The John Crerar Library from current American and foreign literature. For literature searches and translations of technical, industrial, and scientific literature, and photostats and microfilm, write to: Research Information Service, The John Crerar Library, 86 East Randolph Street, Chicago 1, Ill.

AMERICAN FOUNDRYMAN is indexed regularly by Engineering Index, Inc.

Nodular Iron Comparisons

59—High Strength Obtained. G. Vennerholm, H. Bogart and R. Melmoth, "Nodular Gray Iron Compared with Other Cast Ferrous Metals," *Materials and Methods*," vol. 31, Apr. 1950, pp. 51-55.

The production of nodular iron is described along with some of its properties, applications and cost. Tables showing relative efficiency and cost of magnesium addition agents, influence of section size and thermal treatment on the irons, and properties of nodular iron and other ferrous metals are included. Photomicrographs illustrate high strength and ductile type nodular gray irons and effect of section size on the structure. Rehder's work is cited in the hot working of nodular iron at 1,750F with satisfactory results. A tensile strength of 140,000 psi with 4 per cent elongation in the as-rolled condition was obtained. In the rolling operation the nodular graphite is elongated and has an appearance similar to that of wrought iron.

Aluminum—Permanent Mold

60—Automatic Pouring Control. Arthur Q. Smith, "Tilting Crucible for Permanent Molds," *Industrial Gas*, vol. 28, Apr. 1950, pp. 10, 28.

The making of permanent mold aluminum castings by using automatic electronically controlled gas-fired crucible casters is described. When a mold is ready for pouring the operator presses a button. This closes the mold and slowly tilts the crucible. After the mold is full to the gate, the tilting is automatically stopped and for a predetermined time the assembly remains stationary to allow the metal to set. When the metal has set the crucible returns to its original position, the mold opens automatically, and the operator removes the casting. The rate of flow of the molten metal into the mold is controlled by the tilting speed of the crucible.

Steel Foundry Heading—Gating

61—Meet Quality Casting Standards. Fred B. Riggan and Harold Schulte, "Heading and Gating Practice," *The Foundry*, vol. 78, May 1950, pp. 134-137.

A discussion is given with illustrations concerning pattern construction, design, quality and yield. The heading and gating practice exerts the most important influence on the points listed above. Certain procedures are followed in the foundry to meet quality standards, temperature control, gating into a riser tangentially wherever possible, pouring up-hill to eliminate scabs and misruns, keeping gate or runners full at all times, and using a half-round gate to allow harder ramming.

Mold Drying Oven

62—Uses Gas-heated Air. "Molds Dried Rapidly and Uniformly in Car-Type Oven," *Industrial Heating*, vol. 17, Mar. 1950, pp. 490-492, 494.

A car-type oven for the efficient drying of sand molds and cores is illustrated and described. The main points discussed are oven construction, air heater, circulation of air, and controls and safety devices. The air which is heated by gas is moved through a motor-driven 600F fan having a capacity of 12,000 cfm to give ten air changes per minute.

Cast Iron Microstructures

63—Aluminum and Oxygen Additions. W. J. Williams, "The Influence of Low Percentages of Certain Elements on the Microstructure of Pure Iron-Carbon Alloys and Cast Irons," *Journal*, Iron and Steel Inst., vol. 164, Apr. 1950, pp. 407-422.

The influence of small percentages of sulphur, oxygen, silicon, and manganese on the microstructure of pure iron-carbon alloys has been studied. The results prompted further experiments on the influence of aluminum and oxygen additions to cast iron. Aluminum additions modified the form of the manganese sulphide inclusions in cast irons and pure iron-carbon-manganese-sulphur alloys; vacuum melting and inoculation with ferrosilicon produced a similar effect. The diminishing effect of inoculation with respect to time was found to be related to a change in the form of the manganese sulphide inclusions. Superheating influenced the form of the manganese sulphide inclusions and the chilling properties of cast iron. Experiments on the synthetic production of cast iron from pure materials are described, and from further experiments performed it is concluded that: (1) sulphur and oxygen have similar effects on the mechanism of solidification of pure iron-carbon alloys; (2) the effects of inoculation and superheating are probably caused by oxygen; and (3) oxygen in cast irons influences the form of the manganese sulphide inclusions.

Letters to the Editor

All letters of broad interest which do not violate A.F.S. policy or good taste are publishable. Write to Editor, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Letters must be signed but will be published anonymously on request.

Inoculants, Pinholes—Continued

J. E. Rehder (Letters-to-the-Editor, American Foundryman, April, 1950, page 149) objects to the idea advanced that reduction of the diffusion rates of carbon by oxygen may explain the action of inoculants in gray cast iron because the inherently rapid rate of carbon is much too rapid to account for graphitization in this manner. While, admittedly, carbon diffusion is rapid, the fact remains that even with this rapid rate we can get marked changes in graphite structure merely through changes in the cooling rate of the casting. Certainly, then, is it too much to expect that structural differences can also be imposed by conditions which arise within the metal? There is ample experimental evidence that the presence of oxygen in solution drastically reduces the diffusion rate of carbon.

Porosity in gray cast iron containing aluminum is attributed by Mr. Rehder to the presence of a tenacious oxide film on the surface of the metal which prevents escape of the gases. I believe he fails to recognize here the fundamental features of the problem. The principal objection to aluminum is that it causes pinholes. Now if an impervious film caused these pinholes, gassed aluminum castings would be expected to be full of them because of the aluminum oxide film that forms on the casting. But aluminum castings show instead a widespread porosity when gassed. Occasionally, surface porosity on aluminum castings is found, but this is attributed to low permeability or high moisture in the molding sand (outside sources of gas) or to residual concentrations of highly reactive metals like magnesium, calcium, or lithium. Reaction of these metals with moisture at the surface causes pinholes. In the cast at point—aluminum in gray cast iron—dissolved hydrogen would not tend to be removed by oxidation. Hence if present, it, plus the residual aluminum present would aggravate gassing promoted by mold conditions.

Philip C. Rosenthal
Associate Professor
University of Wisconsin

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Cleveland Bank Features Castings Display During Convention

Sponsored by the A.F.S. Northeastern Ohio Chapter, this display in the windows of Cleveland's Second Federal Savings & Loan Association reminded the people of that city that Cleveland's 108 foundries employ 18,450 persons earning more than $58 million annually, rank third in number of employees and earnings among the city's manufacturing industries. Patterns, molds and castings in various stages of completion were contributed by a dozen foundries to the display.

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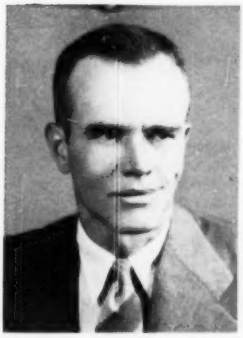

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WHO'S WHO

A. E. Wells

Alfred E. Wells, author of *"How to Build Strength Into Large Patterns,"* Page 38, is foreman of the Pattern Shop of Dominion Engineering Works, Ltd., Montreal, largest general engineering works in the British Commonwealth . . . Born in England in 1898, Mr. Wells attended school in that country before coming to Canada in 1912, where he attended Montreal Technical School. Mr. Wells served as a flight lieutenant in the Royal Flying Corps in World War I.

W. B. Sobers

Winfield B. Sobers, co-author with J. L. Yarne of *"Magnesium Determination in Nodular Cast Iron – Sampling and Analysis Methods,"* Page 33, is metallurgical chemist for Chain Belt Co., Milwaukee . . . Starting as a metallurgical laboratory assistant with Lycoming Motors, Williamsport, Pa., in 1927, he has since served as metallurgist and chemist in several Pennsylvania, Wisconsin and Ohio factories . . . Metallurgical chemist with Chain Belt since 1935, Mr. Sobers has developed and marketed several pieces of laboratory equipment during this period. . . . He has spoken before the Wisconsin Chapter of A.F.S. and the 1944 A.F.S. Convention on ferrous metallurgy and has written on this subject for AMERICAN FOUNDRYMAN and TRANSACTIONS.

J. L. Yarne

John L. Yarne, co-author with W. B. Sobers of *"Magnesium Determination in Nodular Cast Iron – Sampling and Analysis Methods,"* Page 33, is research metallurgist of malleable and gray iron foundries at Chain Belt Co., Milwaukee . . . Graduated cum laude in metallurgical engineering from the University of Wisconsin in 1938, Mr. Yarne became assistant metallurgist at Smith Steel Foundry, Milwaukee . . . His career since then has included five years of research metallurgy at Battelle Memorial Institute and metallurgical positions in Midwest foundries. He has been with Chain Belt for more than four years.

W. E. Mahin

William E. Mahin, co-author with R. A. Lubker of *"Poll Shows Principal Causes for Defective Aluminum Sand Castings,"* Page 51, is director of Research, Armour Research Foundation, Illinois Institute of Technology, and represents ASM on the National Research Council . . . Holder of a B.S. from Notre Dame University (1928) and an M.S. from Carnegie Institute of Technology (1933), Mr. Mahin began his career as assistant metallurgist for Inland Steel Co., Indiana Harbor, Ind. He has since been, successively, research metallurgist, Vanadium Corp. of America, Bridgeville, Pa.; manager of metallurgical Engineering for Westinghouse Electric Corp., Pittsburgh; and at Armour Research Foundation, chairman of metals research and director of research, his present position . . . Mr. Mahin is a member of A.F.S., ASM, AIME, ASTM and the British Institute of Metals and has been a frequent speaker before metals technical organizations.

R. A. Lubker

Robert A. Lubker, co-author with William E. Mahin of *"Poll Shows Principal Causes for Defective Aluminum Sand Castings,"* Page 51, is assistant chairman of metals research at Armour Research Foundation . . . Mr. Lubker attended College of Puget Sound, Tacoma, and holds a B.S. from the University of Washington and an M.S. from Carnegie Institute of Technology in metallurgical engineering . . . From 1942 to 1946, Mr. Lubker was with Westinghouse Electric Corp., Pittsburgh, as non-ferrous metallurgist, engineer and section engineer . . . Since coming to Armour he has been supervisor of non-ferrous metals and his present position, assistant chairman of metals research.

E. M. Cramer

Eugene M. Cramer, co-author with B. Mohr, *"Magnesium Hammer Handles Cast in Permanent Molds,"* Page 28, is a member of the staff of Los Alamos Scientific Laboratories, Los Alamos, N. M. . . . Holder of a B.S. in metallurgical engineering from South Dakota Mines and Technical School and an M.S. in Physical Metallurgy from Washington State College, Mr. Cramer's career has been almost equally divided between industry and research for his alma mater, Washington State College . . . He has been with Los Alamos since last year.

J. J. Farkas

Joseph J. Farkas, author of *"Time Study and Standards Aid Foundry Production Planning,"* Page 45, is a graduate in chemical engineering of Purdue University in 1936, when he was named a distinguished student . . . His career has embraced several phases of quality control, time study and methods engineering in the metals and refining industries . . . He is today industrial engineer with the Cincinnati Milling Machine Co., where he is assistant supervisor of production control, time study and planning for the company's Foundry Division.

F. J. Webbere

Fred J. Webbere, author of *"Auxiliary Oxygen Applied in 72-Inch Production Cupolas,"* Page 40, is senior metallurgist, Research Laboratories Division, General Motors Corp., Detroit . . . A graduate of the University of Wisconsin in 1941, when he held a research fellowship in metallurgy, he served as an Infantry staff sergeant in World War II . . . His work as metallurgist at General Motors has dealt with ferrous metallurgy, cupola studies, casting techniques, alloy development in ferrous and high temperature fields.

R. H. Olmsted

Richard H. Olmsted, author of *"Core Oil Evaluation Method,"* Page 58, is a graduate of Case Institute of Technology (1939) and has since been employed successively as an observer, foundry engineer, metallurgical assistant and laboratory supervisor in several Eastern and Midwestern foundries and is at present sand control supervisor at Lake City Malleable, Inc., Ashtabula, Ohio . . . A member of A.F.S. and ASM, Mr. Olmsted has written for the trade and technical press on cast iron metallurgy.

Alfred W. Gregg Dies

GOLD MEDALIST and chairman of the A.F.S. Educational Division and Chicago Chapter, Alfred W. Gregg, 69, consulting engineer for the Whiting Corp., Harvey, Ill., died at Columbus Hospital, Milwaukee, June 8 following a short illness. Well-

A. W. Gregg

known to the foundry industry, Mr. Gregg was for many years active in the American Foundrymen's Society.

In 1944, Mr. Gregg was awarded the A.F.S. John H. Whiting Gold Medal for his contributions to the industry and for his work in steel melting practice. At the time of his death he served as chairman of the A.F.S. Educational Division, in which he had long played a prominent role, and had been newly-elected chairman of the Chicago Chapter of the Society. He was also a member of the Executive Committee of the A.F.S. Steel Division and last year represented the Society at the 1949 International Foundry Congress, held in Amsterdam, The Netherlands, where he presented the official 1949 A.F.S. paper, *"Ferrous Melting Furnaces in the United States and Canada."*

Holder of a master's degree from Purdue University in 1904, Mr. Gregg served in an executive capacity with Bucyrus-Erie Corp., South Milwaukee, Wis., Bonney-Floyd Co., Columbus, Ohio, and Farrell-Cheek Steel Foundry, Sandusky, Ohio. For the last 14 years, Mr. Gregg had been consulting engineer for the Whiting Corp.

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TEXAS CHAPTER *Secretary*, John M. Morris, Lone Star Steel Co., 6416 Williams Pkwy., Dallas.
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WISCONSIN CHAPTER *Secretary*, J. G. Risney, Risney Foundry Equip. Co., 1307 N. 65rd St., Milwaukee 13.

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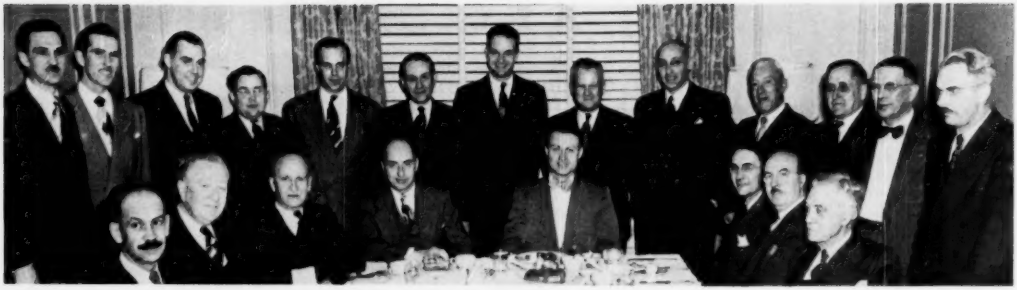


Past chairman, officers and directors attending a director's meeting preceding the April 14 meeting of the Eastern Canada chapter were, standing, left to right: Director Cecil Rowe, Ontario Chapter Director Jack Richardson, Directors A. J. Moore and Marc Chicoine, Treasurer M. E. Fee, Directors Alex Watson and W. Turney Shute; Past chairmen R. Bernard, Henry Louette, C. C. Brisbois, L. Voisard, and A. Cartwright; and Director N. Prunier. Seated, Director Lucien Beaudry, A.F.S. National Director E. N. Delahunt, Honorary Chairman R. W. Bartram, Speaker C. V. Nass, Pettibone Mulliken Corp., Chicago; Chairman J. H. Newman, Secretary J. G. Hunt, Vice-Chairman L. Guilmette; Director H. T. Doran.

CHAPTER ACTIVITIES NEWS

Wisconsin

Robert C. Woodward
Bucyrus-Erie Co.
Retiring President

OFFICERS AND DIRECTORS of the chapter for 1950-51, elected at the chapter's May meeting, are:

President, Walter W. Edens, Badger Brass & Aluminum Foundry Co.; *vice-president*, George E. Tisdale, Zenith Foundry Co.; *treasurer*, Leon H. Decker, Allis-Chalmers Mfg. Co.; and *secretary*, Joseph G. Risney, Risney Foundry Equipment Co.

Directors (to serve three years): E. C. Meagher, Federal Foundry Supply Co.; M. C. Frankard, Delta Mfg. Co.; and H. A. Giebell, Crucible Steel Castings Co. Elected a director to serve one-year is Robert C. Woodward, Bucyrus-Erie Co., retiring chapter president.

Cincinnati District

John F. Kahles
University of Cincinnati
Chapter Reporter

APRIL 10 MEETING of the chapter, held at the Engineering Society, Cincinnati, featured a talk by Clyde A. Sanders, American Colloid Co., Chicago, on *"Modern Progress in Foundry Sand Practice."*

Mr. Sanders discussed the effect of sands on metal shrinkage in castings, a talk which stimulated active discussion on the part of his audience.

Quad City

R. E. Miller
John Deere Planter Works
Publicity Chairman

FORMALLY ELECTED at the May 15 meeting of the chapter was the following slate of 1950-51 officers and directors of the chapter:

Chairman, H. A. Rasmussen, General Pattern Corp.; *vice-chairman*, William C. Bell, Frank Foundries Corp.; *secretary-treasurer*, Robert E. Miller, John Deere Planter Works.

Directors (to serve three years): L. W. Johnson, Swanson Foundry Co.; A. D. Matheson, French & Hecht Co.; and C. R. Marthens, Marthens Co. Elected to serve one-year is D. DeJohn, John Deere Dubuque Tractor Works.

Technical session of the May 15 meeting was devoted to a discussion

Photographed during a post meeting discussion of a talk by R. H. Jacoby, Key Co. East St. Louis, Ill., (third from right) were faculty and student members of the Missouri School of Mines Student Chapter, April 19.

of *"Aluminum Alloys–Fabrication and Application,"* by Walter E. Sicha, Aluminum Co. of America, Cleveland. Following the regular meeting, the A.F.S. film *"Fluid Flow in Transparent Molds"* was shown. Since the speaker had been on the Aluminum-Magnesium Committee which promoted the picture, he was asked to give a running commentary.

Timberline

John W. Horner, Jr.
Slack-Horner Brass Mfg. Co.
Chapter Chairman

ALL MEMBERS of the Timberline Chapter participated in a comprehensive panel discussion of *"Foundry Sands"* at the chapter's May 22 meeting, Oxford Hotel, Denver.

Officers and directors of the chapter elected for 1950-51 are:

Chairman, John W. Horner, Jr., Slack-Horner Brass Mfg. Co.; *vice-chairman*, C. C. Drake, Griffin Wheel Co.; *secretary*, James E. Schmuck, Rotary Steel Casting Co.; and *treasurer* Thomas W. Widener, American Manganese Steel Co.

Directors (to serve three years): Leon Plamondon, Atlas Pattern Works; Jerry Lahr, Aluminum Co. of Denver; Jack Akers, C. C. Card Iron Works; and Warren Prosser, Federated Metals Div., American Smelting & Refining Co.

Tennessee

Carl A. Fischer, Jr.
Fischer Supply Co.
Chapter Reporter

MAXWELL HOUSE, Nashville, was the scene of the April 28 meeting of the chapter. Presiding was Chairman Karl H. Landgrebe, The Wheland Co., with Director Charles Saunders, Tennessee Products & Chemical Corp., in charge of the program.

Speaker of the evening Clyde A. Sanders, American Colloid Co., Chicago, used slides to illustrate his talk on *"Sand Control and Synthetic Sand,"* in which he showed various castings

In a convivial mood at the April 6 meeting of the Saginaw Valley Chapter were, starting left: George Fry, Eaton Mfg. Co., Foundry Div.; Speaker Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.; Chapter Vice-Chairman H. H. Wilder, Eaton Mfg. Co. Foundry Div.; K. H. Preistley, Vassar Electroloy Products; and Roy Dahmer of Eaton's Foundry Div.

New officers of the Birmingham District Chapter are, left to right: Fred K. Brown, Adams, Rowe & Norman, Inc., re-elected secretary-treasurer; Chairman-Elect Morris Hawkins, Stockham Valves & Fittings, Inc.; and Vice-Chairman-Elect C. K. Donoho, American Cast Iron Pipe Company.

At the speakers' Table at the April 18 joint meeting of A.F.S. and ASM Eastern New York Chapters were, left to right: ASM Executive Chairman Eckel; A.F.S. Chapter Chairman K. F. Echard, Eddy Valve Co.; Speaker Howard F. Taylor, Massachusetts Institute of Technology; ASM Chairmen Richards and Savage.

R. A. Colton, American Smelting & Refining Co., Barber, N. J., center, explains a fine point of non-ferrous metallurgy to interested foundrymen following his talk at the April 21 meeting of Tri-State Chapter.

defects and explained how to eliminate them through sand control.

Molding sand properties are a primary cause of metal shrinkage, Mr. Sanders said, as are metal composition, rate of pouring and metal temperatures. Proper sand control, the speaker concluded, will correct this and similar casting defects.

The chapter presented Vanderbilt University's College of Engineering with a complete technical library of A.F.S. publications. Dean Lewis accepted for the University and expressed its gratitude and that of its students for the volumes.

Michiana

J. P. Jordan
Dodge Mfg. Corp.
Chapter Reporter

ELECTED to serve as officers and directors of the Chapter for 1950-51 are the following:

Chairman, William Ferrell, Auto Specialties Mfg. Co.; *vice-chairman*, S. F. Krzeszewski, American Wheelabrator & Equipment Co.; and *secretary-treasurer*, V. C. Bruce, Frederic B. Stevens, Inc.

Directors (to serve three years): Matthew Goodall, Dodge Mfg. Corp.; Roy A. Payne, Sterling Brass Foundry; K. B. Wonnell, Peru Foundry Co.; L. D. Pugh, Casting Service Corp.

St. Louis District

N. L. Peukert
Carondelet Foundry Co.
Chapter Reporter

BOARD OF DIRECTORS met March 30 with A.F.S. National President Edwin W. Horlebein and National Secretary-Treasurer Wm. W. Maloney to discuss chapter plans and policies and means by which the National Office may assist the chapter. President Horlebein outlined the expanded A.F.S. Research Program and was told of a proposed "Rolla Conference," to be held at the Missouri School of Mines this fall by the St. Louis District, Mo-Kan, Tri-State, Central Illinois, Quad City and Timberline Chapters.

April 13 meeting, held at the York Hotel, St. Louis, had as its speaker J. B. Caine, technical consultant of Wyoming, Ohio, who spoke on *"Scabs, Buckles and Spalls."*

Mr. Caine described a simple sand test with hot metal:

First, several finishing brads are welded to a square nut for a ½ in. bolt. Nut is then rammed with an A.F.S. Standard rammer (three rams). Specimen is attached to a ½ in. bolt fastened to a rod. Rod allows specimen of sand to be placed over container of hot metal. By timing, certain properties of the sand may be observed. The test has three variations: (1) holding specimen over molten metal for predetermined time; (2) immersing specimen in metal for given time; and (3) dipping sand specimen in and out of metal several times.

Held at the conclusion of Mr. Caine's talk, the chapter's annual business meeting featured the election of the following officers and directors:

Chairman, John Williamson, M. A. Bell Co.; *vice-chairman*, Ralph M. Hill, East St. Louis Casting Co.; *secretary*, Paul E. Retzlaff, Busch-Sulzer Diesel Engine Co.; and *treasurer*, R. H. Jacoby, Key Co.

Directors (to serve three years): E. R. Belton, Progressive Pattern Co.; C. A. Kenyon, Lewin-Mathes Co.; Henry W. Meyer, General Steel Casting Co.; and Past Chairman George Shepherd, Sterling Steel Casting Co.

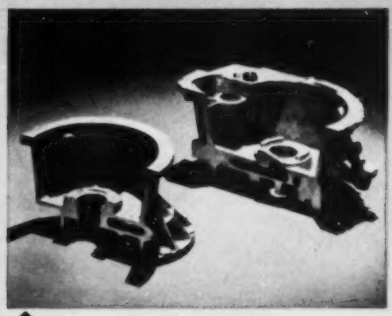
Saginaw Valley

K. H. Priestley
Vassar Electroloy Products, Inc.
Chapter Reporter

SOME 200 MEMBERS AND GUESTS met at the Fischer Hotel, Frankenmuth, Mich., April 6, to hear Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., present a motion picture, *"Men and Molds,"* portraying foundry operations at Lynchburg, and an interesting discussion on nodular iron. At the end of

Dean Lewis of Vanderbilt University's College of Engineering thanks Tennessee Chapter Chairman Karl H. Landgrebe, The Wheland Co., Chattanooga, right, for Tennessee Chapter's gift of a complete library of A.F.S. publications at a dinner held in Nashville's historic Maxwell House. Vanderbilt is the third Tennessee university to receive a library from the chapter. Others were the universities of Tennessee and Chattanooga.

Radiograph showing how the oil passage walls could be checked without damage to the casting.



Cutaway showing oil passage which required accurate and uniformly thick walls.

Only Radiography could check this vital specification

THIS sand cast aluminum housing for a high-altitude air pump included passages to carry oil at very high pressures. Specifications called for passage walls of accurate and uniform thickness.

There was one way to check this important specification—one sure way for the foundry to be absolutely certain of releasing only sound and satisfactory castings. Radiographic inspection was the way.

Radiography is becoming more and more routine with foundries assigned important tasks. On critical castings, such as this, it may be used to assure freedom from core shifts immediately before pouring and as a final casting inspection tool. Most valuable of all, radiography reveals internal defects during the pilot casting stage and suggests the changes needed to assure high yield in the production run.

, , ,

Ask your X-ray dealer to explain the many ways radiography can increase your yield and better your foundry operations.

EASTMAN KODAK COMPANY

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Radiography...

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TRADE-MARK

At the March 27 meeting of Northwestern Pennsylvania Chapter were (left) Chairman Joseph A. Shuffstall, National Erie Corp., and Speaker W. B. McFerrin, Haynes Stellite Division, Union Carbide & Carbon Corporation.

his talk, Mr. Kuniansky commented briefly on his recent trip to Europe, during which he visited many foundries in several countries.

The last four Thursdays in March were given over to the chapter's Foundry Educational Series, designed to acquaint area high school and technical students with the foundry industry and its possibilities as a career for young men. Two of these meetings were held in Flint and two in Saginaw, one of the latter a visit to Central Foundry Division of G.M.C. So many students indicated interest in this visit that members of the chapter were asked to postpone their visit until April 20.

Rochester

Donald E. Webster
American Laundry Machine Co.
Publicity Chairman

MORE THAN 350 MEMBERS and guests met at the Hotel Seneca, Rochester, on May 19 for the chapter's annual business meeting. The head table was filled with civic and business leaders of the community, including Mayor Samuel B. Dicker of Rochester. This record turnout was a tribute to the leadership of Retiring Chapter President Herman G. Hetzler.

Following dinner, Henry B. Hanley of American Laundry Machine Co., who was instrumental in the chapter's formation and who served as its first president, spoke on the substantial progress the chapter has made during its comparatively brief history and emphasized the need for continuation of the able leadership the chapter has had in the past to the end that the chapter may continue to grow in strength and service to the industry.

Following reports of the president, secretary and treasurer, the following officers and directors for 1950-51 were unanimously elected:

President, Kenneth R. Proud, Anstice Co.; *vice-president*, Charles Vaughn, Ritter Co.; *secretary-treasurer*, Duncan Wilson, American Brake Shoe Co.

Directors (to serve three years): Leon C. Kimpal, Rochester Gas & Electric Corp.; John Racinowski; Rochester-Erie Foundry Co.; W. B. Sattler, Whitehead Bros. Co.; and Herman G. Hetzler, Hetzler, Hetzler Foundries, Inc. (to serve one year).

Saginaw Valley

R. H. Klawuhn
General Foundry & Mfg. Co.
Chapter Vice-Chairman

1950-51 OFFICERS and directors of the chapter, elected at a recent meeting, are:

Chairman, Howard H. Wilder, Eaton Mfg. Co., Foundry Division; *vice-chairman*, Raymond H. Klawuhn, General Foundry & Mfg. Co.; *secretary-treasurer*, Walter Bohm, Buick Motor Co.

Directors (to serve three years): F. James McDonald, Central Foundry Div., GMC; Mendel Fair, Valley Steel Casting Co.; and Otto Nickodemus, Vassar Electroloy Products.

Birmingham District

J. P. McClendon
Stockham Valves & Fittings
Publicity Chairman

NAMED CHAIRMAN of the chapter at the April 21 meeting was Morris L. Hawkins, Stockham Valves & Fittings.

Mr. Hawkins succeeds C. P. Caldwell, who presided at the meeting. Other officers elected at the meeting were Charles K. Donoho, American Cast Iron Pipe Co., vice-chairman, and Fred K. Brown, Adams-Rowe & Norman, re-elected secretary-treasurer.

New members of the board of directors elected are C. P. Caldwell, Ray Farabee, R. L. Jackson, M. W. White and Donald Abbott, who was re-elected to a three year term.

The dinner and technical session which followed was well attended. "*Magnesium-Containing Cast Irons*" was discussed by R. J. Rice, Research

Occupying speakers' table at the May 1 meeting of the Western Michigan Chapter, Cottage Inn, Muskegon, were, left to right: Treasurer L. D. Ramsey; Paul M. Wiener Foundry Co.; Vice-Chairman S. H. Davis, Campbell, Wyant & Cannon Foundry Co.; Speaker Robert P. Schauss, Illinois Clay Products Co., Chicago; Chairman C. N. Jacobson, Dake Engine Company; and Treasurer Lauren D. Ramsey, Paul M. Wiener Fdy. Co.

Victor Rowell, Traybon Co., South Bend, Ind., was Gray Iron Group Speaker at the April meeting of the Wisconsin Chapter. (photo courtesy W. V. Napp, Badger Fire Brick & Supply Co., Milwaukee).

FUTURE CHAPTER MEETINGS

● ***JUNE 17***

DETROIT
Hillcrest Country Club, Detroit
ANNUAL SPRING OUTING

QUAD CITY
Camp Nobel, Rock River, Moline, Ill.
ANNUAL OUTING

● ***JUNE 24***

CENTRAL MICHIGAN
Cascades Country Club, Jackson
ANNUAL OUTING

● ***JUNE 30***

NORTHEASTERN OHIO
Lake Forest Country Club
ANNUAL OUTING

George P. Antonic, Walter Gerlinger, Inc., Milwaukee, was chairman of the Gray Iron Group at Wisconsin Chapter's April meeting. (Photograph courtesy of Walter V. Napp, Badger Fire Brick & Supply).

Division, International Nickel Co., Houston, Texas. His talk was illustrated with slides to emphasize the results outlined. A lively discussion period followed the talk.

Warren Jeffry, University of Alabama, announced that 16 students had already paid their dues and the group had made application for membership as a Student Chapter.

Tri-State

Dale Hall
Oklahoma Steel Castings Co., Inc.

SPEAKER at the March 19 meeting, held in Coffeyville, Kan., was R. G. McElwee, Vanadium Corp. of America.

The speaker's subject was *"Research as Applied to the Foundry,"* and Mr. McElwee pointed out the necessity of having skilled personnel to cope with the high cost of manufacture and the rigid specifications required of the foundry.

Prior to the general meeting, Chairman C. A. McNamara, Jr. appointed a nominating committee to select a slate of officers for the coming year.

Non-ferrous foundrymen and guests met at Hotel Lassen, April 12, in Wichita, Kansas. The speaker was R. A. Colton, Federated Metals Div., American Smelting & Refining Co. The subject was *"Bronze Casting Defects."*

Mr. Colton illustrated various types of defects with non-ferrous castings, explaining the cause and remedy. One of the main points of the discussion was the formation of gas holes caused by hydrogen and oxygen. The speaker pointed out that the melting practice had a great bearing on the two elements and that defects could be reduced with proper melting control.

At the speakers' table at the April dinner meeting of the Northern Illinois-Southern Wisconsin Chapter were, left to right: Carl Dahlquist, Greenlee Bros. & Co., chapter secretary; Vice-Chairman F. W. Thayer of Gunite Foundries Corp.; Speaker B. C. Yearley, National Malleable & Steel Castings Co.; Chapter Chairman Lester C. Fill, George D. Roper Corp.; and Chapter Treasurer J. Rundquist, Beloit Castings Co., Beloit, Wisconsin.

Central Michigan

Fitz Coghlin, Jr.
Albion Malleable Iron Co.
Chapter Reporter

NOMINATED for officers and directors of the chapter for 1950-51 are the following:

Chairman, Jack F. Secor, Hill & Griffith Co.; *vice-chairman*, David E. Sherman, Engineering Castings, Inc.; *secretary-treasurer*, Thomas T. Lloyd, Albion Malleable Iron Co.

Directors (to serve three years): Richard K. Moore, Foundries Materials Co.; Maynard B. Fiandt, Superior Brass & Aluminum Castings Co.; and Palmer B. Coombs, Riverside Foundry & Galvanizing Co. Nominated to serve a one-year term is George Petredean, Calhoun Foundry Co.

Washington

Fred R. Young
E. A. Wilcox Co.
Chapter Secretary

NOMINATED AND ELECTED TO SERVE as officers and directors of the chapter during 1950-51 are:

Chairman, Stanley H. Marshall, Atlas Foundry Co.; *vice-chairman*, James D. Tracy, Salmon Bay Foundry; *secretary*, Fred R. Young, E. A. Wilcox Co.; and *treasurer*, R. N. Tompkins.

Directors (to serve three years): Gilbert S. Schaller, University of Washington; James Dolansky, Griffin Wheel Co.; and William L. Mackey, Washington Stove Works.

(Continued on Page 86)

FOUNDRY *Personalities*

Joseph M. Beyvl, since 1942 assistant to the president of the Foundry Equipment Co., Cleveland, was elected a vice-president of the company at its annual meeting. Mr. Beyvl, who has been with Foundry Equipment since 1935, is a specialist in conveyor type core and mold ovens and will continue in this capacity in addition to his new duties as vice president.

New executive appointments announced by the International Graphite & Electrode

J. W. Lohnes

Corp., St. Marys, Pa., are: **John W. Lohnes,** manager of sales, to be vice-president in charge of Carbon and Graphite Sales for International and its parent company Speer Carbon Co.; **William E. Harvey,** plant manager at Niagara Falls, to be plant manager of all carbon and graphite plants of Speer and subsidiaries; and **Robert E. Rice,** assistant sales manager of International Graphite, to be sales manager.

Raybestos-Manhattan, Inc., Passaic, N. J., announces the election of **George R. Weber** as treasurer, succeeding **W. H. Dunn,** who retired recently. **W. S. Simpson** was elected secretary and **W. Ward Kievit** a director of the corporation.

Allis-Chalmers Mfg. Co. stockholders recently re-elected **Walter Geist** to his ninth term as company president and re-elected all officers and directors of the firm. Officers re-elected are: **W. C. Johnson,** executive vice-president in charge of General Machinery Div.; **E. H. Brown,** vice-president in charge of Engineering Development; **W. A. Roberts,** executive vice-president in charge of Tractor Div.; **W. E. Hawkinson,** secretary-treasurer; **J. A. Keogh,** vice-president and comptroller; **J. L. Singleton,** vice-president and director of sales, General Machinery Div.; and **H. W. Story,** vice-president and general attorney. Directors re-elected are: **James M. Barker, Fred O. Bohen, W. C. Buchanan, Hugh Comer, Walter Kasten, Ernst Mahler, Louis Quarles, Leigh Willard,** and Messrs. Geist, Roberts and Johnson.

Joseph O. Danko, Jr., formerly mill room foreman for Ferro Machine & Foundry Co., Cleveland, has been named chief engineer for Arlington Bronze & Aluminum Corp., Baltimore. A Navy veteran of World War II, Mr. Danko is a graduate of Cornell University, where he was one of the first FEF scholarship students.

George C. Sharp, a member of the law firm of Sullivan and Cromwell, general counsels to the International Nickel Co. of Canada, Ltd., has been elected to International's Board of Directors, filling a vacancy left by the resignation of **John Foster Dulles,** newly-appointed special advisor to U. S. Secretary of State Dean Acheson. Son of the late William Graves Sharp, U. S. Ambassador to France during World War I, Mr. Sharp has served with the American Embassy in Paris, and during World War II, was with the Army's O.S.S. branch and later served as legal advisor to the S.H.A.E.F. Mission to France.

Jack W. Giddens, formerly with the International Harvester Co., Indianapolis, has joined the staff of the Wells Manufacturing Co., Skokie, Ill. Mr. Giddens resigned as vice-chairman of the A.F.S. Central Indiana Chapter upon acceptance of his new position and is now affiliated with the Society's Chicago Chapter.

Walter S. Howard has been named sales engineer for automotive castings for the Lake City Malleable Co., Cleveland. Mr. Howard, who was formerly director of quality control for the White Motor Co., Cleveland, has for many years been active in committee work for the Society of Automotive Engineers and is a former chairman of that Society's Cleveland section.

Dr. George H. Zirker has been appointed chief metallurgist for Burndy Engineering Co., Inc., New York. Prior to his association with Burndy, Dr. Zirker was for many years chief metallurgist for Foundry Services, Inc., New York, and has served as foundry consultant and metallurgist for Carnegie-Illinois Steel Corp., Permanente Metals Corp. and Taylor & Co.

Sam Tour, chairman of the Board of Directors of Sam Tour & Co., Inc., New York; and president of Graphitized Alloys Corp. and Forty Four Trinity Place Corp., both of New York, has been elected chairman of the Inter Society Corrosion Committee of the National Association of Corrosion Engineers. Mr. Tour is a Past National Director of A.F.S.

A. J. Edgar, since last September general manager of the 138-year-old Hunt-Spiller Mfg. Corp., Boston, has been elected a vice-president of that organization. During World War II, Mr. Edgar served in Washington as technical advisor for the Gray

A. J. Edgar

Iron Founders' Society, and prior to that held executive positions in foundries in Michigan, Illinois and New York.

H. G. Ebdon and **William P. E. Ainsworth** were recently elected vice-presidents of Combustion Engineering-Superheater, Inc., New York. Mr. Ebdon, who joined the company in 1917, was formerly general sales manager of boilers and related equipment. He will continue to serve the company in this capacity in addition to new duties. Mr. Ainsworth has been with the company since 1921, and will continue in charge of purchasing and production.

Five vice-presidents elected at the April 17 meeting of the Harbison-Walker Refractories Co. are: **F. H. Atwood,** formerly assistant general counsel, who will serve as vice-president in charge of industrial relations; **G. F. Cronmiller, Jr.,** who will also continue his duties as secretary of the company; **W. F. Rochow,** since 1947 assistant to the president, who will be vice-president in charge of technical sales and research; **H. L. Smalley,** new vice-president in charge of sales, who has been with the company 28 years; and **E. T. Hile,** formerly assistant to the vice-president in charge of operations, who will be vice-president in charge of manufacturing. Re-elected by the Board

were **E. A. Garber,** president and general manager, and **W. F. Bickel,** treasurer. **W. F. Godejohn,** formerly vice-president in charge of operations, was named senior vice-president. **J. E. MacCloskey,** chairman of the Board, declined re-election but will serve as a director and general counsel. **G. G. Coolidge,** vice-president and director, relinquished his post as vice-president but will continue to serve as a director of the company.

Carl J. Parsch, formerly with Simons-Michelson Advertising Agency, Detroit, has been named advertising manager of the Acheson Colloids Corp., and will devote part of his time to market research and sales promotion.

L. C. Wilson of Reading, Pa., Past National President of A.F.S. (1944-45), has established Bearings, Inc., at 716 Washington St., Reading, for handling anti-friction

L. C. Wilson

bearings. Until recently Mr. Wilson represented several castings manufacturers in the East.

Marshall E. Cusic, formerly assistant sales manager of the Rex Chain and Transmission Sales Dept. of the Chain Belt Co., Milwaukee, has been named a Pittsburgh district sales engineer for the company.

Sterling N. Farmer, vice-president, Sand Products Corp., Cleveland, was recently elected president of the National Industrial Sand Association. Mr. Farmer, who has long been active in the A.F.S. Northeastern Ohio Chapter, served as vice-chairman of the Publicity Committee for the 54th Annual A.F.S. Foundry Congress & Show, held May 8-12 in Cleveland.

Two Allis-Chalmers Mfg. Co. foundry employees who recently were presented with gold watches by Allis-Chalmers President Walter Geist upon completion of 50 years' service with the company are **Charles A. Bergemann** of the No. 1 Foundry and **Martin Ptak** of the Brass Foundry.

H. H. Morgan, vice-president and chief engineer of the Robert W. Hunt Co., Chicago engineering firm, has been named general manager of that organization. Mr. Morgan will continue to serve as vice-president and chief engineer in addition to his new duties.

Carl W. Schaffner, formerly manager of the Spencer Heater Division of Avco, Williamsport, Pa., has joined Sprout, Waldron & Co., Inc., Muncy, Pa., as superintendent of iron foundries.

H. M. Rich, Jr., has been appointed Division vice-president of the Electro Metallurgical Division, Union Carbide & Carbon Corp., and will make his headquarters in Pittsburgh. **W. H. Ferguson,** New York area sales representative, has been named Eastern manager. **Robert W. Crozier** has been named sales representative in the Pittsburgh area.

L. P. Robinson, vice-president in charge of sales for the Werner G. Smith Co., Cleveland, has been named vice-president in charge of the Foundry Sales Division of

L. P. Robinson

the Archer-Daniels-Midland Co., Cleveland, newly-created successor to the Werner G. Smith Co. With experience in core oil sales dating back to 1917, Mr. Robinson has been a frequent speaker before A.F.S. chapters on foundry oil technology, and has been responsible for expansion of Smith core oil sales.

Andrew Van Echo, formerly metallurgist for William E. Pratt Mfg. Co., Joliet, Ill., subsidiary of Joslyn Mfg. & Supply Co., has joined the parent company at Fort Wayne, Ind., as assistant superintendent. Mr. Van Echo was chief testing inspector with Joslyn from 1945 to 1947, prior to joining Pratt Mfg. Co.

Sylvester E. Mueller, formerly with Continental Foundry & Machine Co., Wheeling, W. Va., and the Falk Corp., Milwaukee, has been elected vice-president in charge of operations and engineering of Boston Electro Steel Casting, Inc., Boston, Mass. Holder of degrees in metallurgical engineering from Marquette University and the University of Wisconsin, Mr. Mueller is a past director of the Wisconsin Chapter of A.F.S.

Kenneth F. Ode has been appointed manager of operations, with headquarters in Pittsburgh, according to H. A. Forsberg, vice-president of Continental Foundry & Machine Co. Until recently Ode was manager of the Findlay Div., Gar Wood Industries, Inc., and before that was works manager of Trackson Co., Milwaukee. A graduate in engineering of Marquette University, Ode spent about 14 years with Falk Corp., Milwaukee, where he held a number of positions including plant engineer and weld shop superintendent. During World War II he was a management representative on the Management-Labor Policy Committee of the Office of Production Management.

OBITUARIES

Raymon T. Melville, 67, Western New York District sales manager for Hanna Furnace Corp., died recently at his home in Buffalo. A member of the A.F.S. Western New York Chapter since its inception, Mr. Melville had been active in the metals industries for 49 years, and had been with Hanna since 1927.

Albert J. Lent, 51, general superintendent of the United States Graphite Co., Saginaw, Mich., died April 5 in that city. Graduated from the University of Michigan in 1921 with a B.S. in Metallurgical Engineering, Mr. Lent joined U. S. Graphite the following year, working up through the company's organization to become general superintendent.

L. D. Holland, assistant to the president and a member of the Board of Directors of E. F. Houghton & Co., Philadelphia, died April 24 at the age of 46 after a prolonged illness. Mr. Holland had been with Houghton since 1927 as a sales representative, Western Division sales manager, manager of Research Sales, assistant general sales manager and assistant to the president of the company.

Fred Snyder, for 20 years a sales representative for the Bonney-Floyd Co., Columbus, Ohio, died April 13 at his home in Oakmont, Pa.

Elwood F. Thum, Sr., 64, president of the Palmyra Foundry Co. Palmyra, N. J., died April 10 at his home in Ormond Beach, Fla. Mr. Thum, who was 64, had been connected with the foundry industry for 48 years during which he also founded the Abrasive Alloy Castings Co., Bridgeboro, N. J. He is survived by his son, Elwood, Jr., who is president of Abrasive Alloy Castings Co.

E. J. Thomas, president, Progressive Brass Mfg. Co., Tulsa, Okla., died May 18 at his home in Tulsa. He founded the company in 1913 in Kansas City, Mo., and until 1939 operated a plant there. The Tulsa plant was started in 1927 and 12 years later the Kansas City plant was combined with it.

Mr. Thomas was a member of A.F.S. for many years and was greatly interested in Tri-State Chapter activities. He was a past international president of the Co-operative Club and a member of the Shrine.

John C. Stiefbold, foundry superintendent, De Laval Steam Turbine Co., Trenton, N. J., died April 29. Mr. Stiefbold had been with the company since 1909.

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In machining gray iron castings that have been deoxidized with FERROCARBO silicon carbide Briquettes, it has been found that tools last as much as one-third longer. Other important savings are realized through reduced machining time and fewer rejected castings.

These economies result from the improved structure of the treated iron which is dense, close grained and free from chill or porous areas. This is true even in castings that vary widely in cross sectional area.

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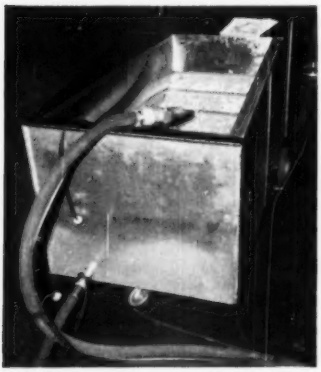
NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 616 S. Michigan, Chicago 5, Ill. Refer to the item by means of the convenient code numbers.

Refractory Linings Ram

JN1—"One Man Ram" utilizes air placement method plus ramming to install monolithic refractory linings in cupolas, ladles, electric furnaces and other molten



metal handling equipment. Fully adjustable for any conditions, unit uses wet or dry, acid or basic materials with equal facility. One man does complete job, producing linings of uniformly low moisture content and high density. Hopper capacity is 1300 lb in single loading. *Firegan Sales Co., Board of Trade Bldg., Chicago 4, Ill.*

Pneumatic Vibrator Assembly

JN2—Type SAH pneumatic vibrator assembly is versatile and portable. Alloy steel stud facilitates rapid insertion into sleeve-type mounting bracket, providing efficient transfer of vibration to hoppers, bins, screens and flasks. Vibrators, designed for continuous operation, are furnished in two standard sizes: (1) 1¼ in. size, delivering 2500 vibrations per min, and (2) two-inch size, delivering 1250 blows per min, both in 100-lb line pressure. Vibrators will operate on line pressures ranging from 50 to 100 psi, and have 360-degree intake swivel connector for ease of positioning and handling. *Cleveland Vibrator Co., 2786 Clinton Ave., Cleveland 13.*

Lift Truck Scoop Shovel

JN3—Hydraulically-operated scoop shovel attachment for fork trucks eliminates manual shoveling when scooping, lifting, moving and dumping sand, coal, dry chemicals and similar loose materials. Scoop handles up to 27 cu ft of material, tilting upward to cradle load, then downward to discharge. Device scoops at ground level or digs into piled material, and dumps loads into bins, vats, hoppers, mixers and other receptacles at heights up to 130 in. *Yale & Towne Mfg. Co. Philadelphia Division, Philadelphia, Pa.*

Pencil-Sized Hydrometer

JN4—Designed for measuring gravity of mold or core coating suspensions, pencil-sized hydrometer may be carried in pocket.

Clear plastic body encloses Beaume scale ranging from 0 to 70 for heavier-than-water mixtures. Hydrometer can be used in foundries for measuring concentration of siliceous or carbonaceous washes, sprays, dipping or brushing mold or core coating materials. May also be used for gravity measurements of slurries and paints. *Harry W. Dietert Co., 9330 Roseclawn Ave., Detroit 4.*

Shakeout

JN5—One-ton capacity Foundromatic Shakeout is equally applicable to horizontal or slope deck operation. Rubber-

mounted, shakeout has single seal mechanism and is easily installed and maintained because of minimum number of parts. *Allis-Chalmers Mfg. Co., Milwaukee, Wis.*

Molding Machines

JN6—Pneumatic jolt, squeeze, turnover and pattern draw machines feature (1) timer easily adjustable to any number of jolts, (2) pushbutton operation, (3) automatic lubrication, (4) fully-automatic pneumatic anvil, (5) built-in air filters, (6) rigid but smooth-operating swing arm, (7) easy mold removal, and (8) minimum of maintenance. Specifications are: 400 lb jolt capacity; 7,000 lb squeeze pressure, 8 in. pattern draw; 67 in. turning arc; 13.2 cu ft air consumption per ½ mold; 7 in. squeeze adjustment; and 26 x 19 in. table dimensions. Full line of parts are available for these British-made machines in the United States and Canada. *British Molding Machine Co., Ltd., Faversham, Kent, England.*

Hydraulic Vise

JN7—Hydraulic vise for casting cleaning operations is foot-operated, enabling operator to use both hands to lift and position casting into vise. He then pushes pedal and front jaw of vise closes and securely holds casting in required position, remaining locked until release pedal is pushed. Jaws can be clamped without

crushing or marring light castings and air hammer vibration will not cause jaws to loosen. *Columbian Vise & Mfg. Co., 9017 Bessemer Ave., Cleveland 4.*

Non-Melting Lubricant

JN8—Plastilube, an all-purpose lubricant that has no melting point, possesses excellent adhesive qualities, good pumpability at low temperatures and will not break down during working. Compara-

tive tests with barium and lithium greases showed that greases melted at 345 F while Plastilube was unaffected by heat. Adaptable for virtually every industrial lubricating application, Plastilube will not break down or melt away and thus has longer service life. *Warren Refining & Chemical Co., 750 Prospect, Cleveland 15.*

Industrial Microscope

JN9—Wide field industrial 20-power microscope with stand is designed to withstand rough handling of shop use. Micro-

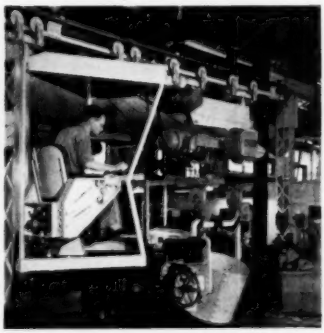
scope may be angled in any direction and raised and lowered to accommodate pieces up to 12 in. high. Long-working distance and large aperture lenses permit use with relatively low illumination levels. Fine focus is obtained with built-in helical focusing eyepiece. Stand is portable. Tube is available without stand for bench mounting. *Buhl Optical Co., 1009 Beech Ave., Pittsburgh 12.*

Portable Shakeout

JN10—Designed to eliminate the shovel from the molding floor, the Reddy Sandy, a portable shakeout and sand tempering unit, performs complete shakeout cycle, automatically feeding sand to conditioning machine. Operation sequence is: (1) dump flasks on grate of Reddy Sandy, not on floor, (2) without shoveling of any type, unit breaks up sand and removes tramp metal by magnetic separation, and (3) uniformly adds tempering water and discharges sand to any convenient conditioner. Sand never touches floor. Reddy Sandy grate and hopper is of convenient height for mold shakeout. Unit is easily moved by one man, occupies only 3 x 10½ ft of floor space, handles up to 10 tons of sand per hour, and can be used for mold sizes up to 20 x 30 in. Magnetic separator is detachable for non-ferrous foundry work. Unit is furnished complete with motor, starter, pushbutton and 50 ft of cable with plug and receptacle. Water conditioning unit is optional. *Newaygo Engineering Co., Newaygo, Mich.*

Magnetic Crane Controls

JN11—New system of magnetic crane controls enables crane operator to remain comfortably seated during all operations. Master switches occupy little space, give operator full vision at all times and require only finger tip operation. Priced between drum-type control and conventional magnetic control, unit requires no



contact maintenance, is light in weight, and can be easily converted from drum-type controllers. *Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.*

Reinforced Hub Wheel

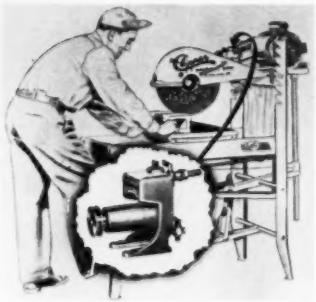
JN12—Lighter and more easily handled than the conventional 6 in. flaring cup wheel and longer lasting than coated abrasive discs, reinforced hub-shaped grinding wheel is designed for all standard right-angle portable grinders and sanders. Reinforced with layers of fabric and equipped with safety web, wheel cuts rapidly without spalling or loading. Claimed by manufacturer to outlast wheels of similar type two or three times, wheel will rough and finish grind and notch. Particularly applicable to cutting non-ferrous gates and risers, notching prior to breaking off, removing mold marks and smoothing up machine bases on large castings preparatory to painting. *Norton Co., 19 New Bond St., Worcester 6, Mass.*

Floor Magnet

JN13—Long low-clearance handles of the Rotary Floor Magnetool permit operator to pick-up steel chips from hitherto inaccessible places without stooping. Propelled carpet sweeper fashion, Magnetool features a powerful magnetic tube which rotates with the wheels. Steel chips and shavings jump to tube, loading automatically over entire surface of roller. Neoprene wiper ring pushes parts to non-magnetic area at either end to unload. Wear-proof inertia brakes prevent roll when unit is not in use. Magnetools are water- and oil-proof, with acid-proof models for use in tank solutions. *Multi-finish Mfg. Co., Detroit 7, Mich.*

Sealed Water Pump

JN14—Factory-sealed water pump that can be operated dry without damage is designed to operate with Clipper HD



masonry saw. "Wet or Dry" pump eliminates damage caused to saw blades by letting water supply in reservoir run low or by stopped-up waterlines. *Clipper Mfg. Co., 2800 Warwick, Kansas City 8, Mo.*

All-Purpose Sand Blower

JN15—Applicable both to jobbing and production foundries, all-purpose sand blower blows any sand, regardless of green strength, core oil, dry core binder or molding sand. Blows single cores up to 40 lb or 40 lb of small cores, without refilling or moving blow head. Other features: (1) changing coreboxes requires but one simple adjustment, (2) single valve automatically controls blowing and clamping, (3) cores blown through one hole in blow plate, so plate does not have to be replaced for each corebox, (4) handles coreboxes up to 18 in. wide, 12 in. high, and 24 in. long. Hopper holds 200 lb of sand. *Federal Foundry Supply Co., 4600 E. 71st St., Cleveland.*

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FOUNDRY Literature

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Foundry Practice Bulletin

JN101—Issue No. 97 of *Foundry Practice*, technical bulletin available periodically to readers of AMERICAN FOUNDRYMAN, contains an investigation of normal piping associated with gross porosity of pure copper risers; a table showing chemical composition of unalloyed irons suitable for different classes of castings; an explanation of formation of hard spots in castings due to use of chaplets or studs; information on designing of simple molds for permanent mold castings; and brief articles on casting a fuse box door in aluminum alloy and definitions and formulae relative to foundry work. AMERICAN FOUNDRYMAN readers are invited to receive mailings of *Foundry Practice* by writing *Foundry Services, Inc., 280 Madison Ave., New York 16.*

Metal and Alloy Properties

JN102—A 37-page booklet compiled from the feature, "The Technical Editor Speaks," published periodically in *Mechanical Topics*, explains the mechanical properties of metals and alloys. Not designed as an exhaustive study of physical metallurgy, booklet serves the reader as a guide to technical yardsticks and gages useful to foundrymen and others working with metals. Contents include sections on tensile properties, torsional properties, hardness, toughness, low and high temperature properties, corrosion resistance, heat transfer properties and many others. *Development and Research Div., International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.*

Foundry Ventilation

JN103—"What Price Fresh Air?" is the title of a folder describing features of the Iron Lung. Listed are such advantages as trouble-free performance, discharging of toxic air as high as 30 ft above foundry roof to eliminate possibility of re-intake of impure air, low installation and maintenance costs, leakproof, and modern design of unit. Also shown in folder are typical foundry installations. *Iron Lung Ventilator Co., 4019 Prospect Ave., Cleveland 3, Ohio.*

Melting Furnace

JN104—Applications, specifications and advantages of the McEngelvan Speedy Melt metal melting furnace as given in a four-page folder. Features are wide melting range, shorter melting schedules possible, proper combustion to assure clean hot metal for pouring, safe operation through elimination of fumes, operation on any type of fuel gas, low operating and low maintenance costs. Furnace is available in three standard models. *Western Materials Co., 39 South LaSalle St., Chicago 3.*

Industrial Consultants

JN105—"Facts for Business Policy," a four-page folder, describes and cites examples of this consulting industrial research firm's revamping of such industrial procedures for clients as distribution policy, revitalizing of product lines, development of potential markets, appraising trends and selection of plant sites. Operations of this organization may be classified as mechanical engineering, chemical engineering, biological, physical and economic. *Arthur D. Little, Inc., 30 Memorial Drive, Cambridge, Mass.*

Waste Heat Recovery

JN106—A report written by J. L. Michener, plant engineer for Schramm, Inc., West Chester, Pa., and reprinted from *Power* magazine, describes a system for recovering lost heat by teaming engine compressors with unit heaters. Engines are equipped with marine-type, water-cooled manifolds. Water coming off engine jackets picks up btu's that would otherwise be exhausted to atmosphere and wasted. Water is taken directly from discharge of engine-compressor cooling system and circulated by engine pump through heating equipment. Cost of equipment and piping is relatively small. Copies of reprint are available without charge from *Compressed Air and Gas Institute, Office of Educational Committee, 1404 Terminal Tower, Cleveland 13, Ohio.*

Cerium in Nodular Iron

JN107—"Production of Nodular Irons With Cerium—Some Practical Details," an eight-page booklet gives details of actual practice in adding cerium to molten metal, as developed by the British Cast Iron Research Association. *Cerium Metals Corp., 153 Waverly Pl., New York.*

Radiation Pyrometer

JN108—A new bulletin on the Bristol Radiation Pyrometer explains the theory of radiation pyrometry and features of this unit. Included are photographs and diagrams illustrating accessories for adapting the unit for uses with furnaces and kilns for indicating, recording and controlling temperatures up to 4000 F. *Bristol Co., Waterbury 20, Conn.*

Lift Truck Attachments

JN109—A complete line of lift truck attachments, tools and accessories is described in a 28-page illustrated booklet. Specifications and applications are outlined for such attachments as load grabs, booms, forks, guards, rams, scoops, aprons, cabs, tow hooks, free lifts, clamshells, special tires, meters, controls, light systems, fire extinguishers, mirrors, etc. *Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.*

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JN 103	JN 106	JN 109

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BOOK NUMBER		MEMBER PRICE	LIST PRICE
1	Alloy Cast Irons Handbook (2nd Edition)	$2.75	$ 4.50
2	Aluminum Foundry Process Control (SAE)	1.00	2.50
39	AFS Foundry Apprentice Course Outline	1.00	2.00

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8	Development of the Metal Castings Industry	5.00	8.50
38	Foundry Core Practice (2nd Edition)	6.50	10.00
9	Foundry Cost Methods	1.50	3.00
10	Foundry Dust Control	1.00	2.00
11	Foundry Process Control (SAE)	1.50	2.50
12	Foundry Sand Testing Handbook (5th Edition)	2.25	4.00
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17	Malleable Iron Melting	2.25	4.00
18	Permanent Mold Castings Bibliography	1.50	3.00
19	Recommended Good Practice Code and Handbook on the Fundamentals of Design, Construction, Operation and Maintenance of Exhaust Systems	3.00	5.00
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24	Recommended Practices for Sand Casting Aluminum and Magnesium Alloys	1.00	1.75
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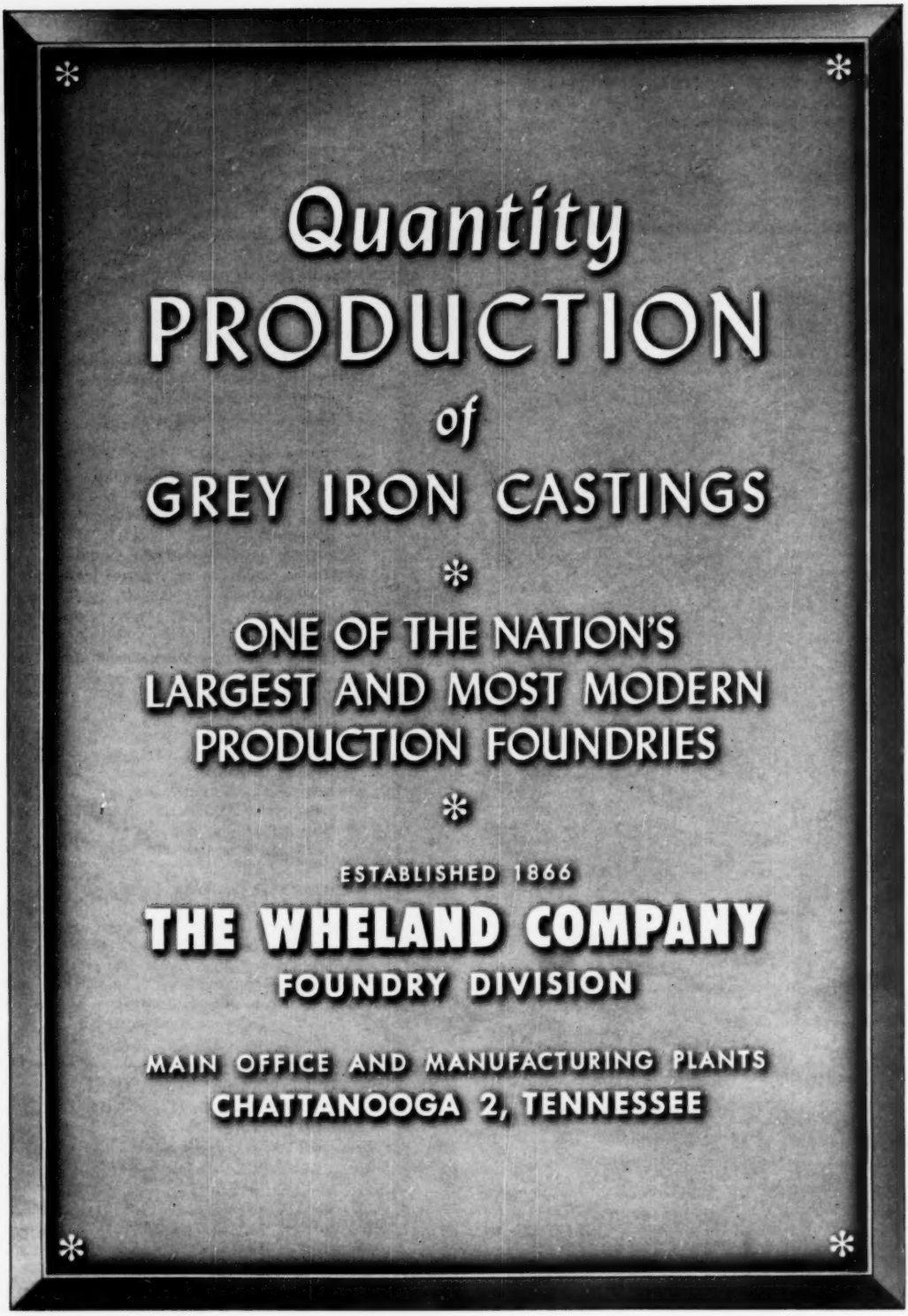
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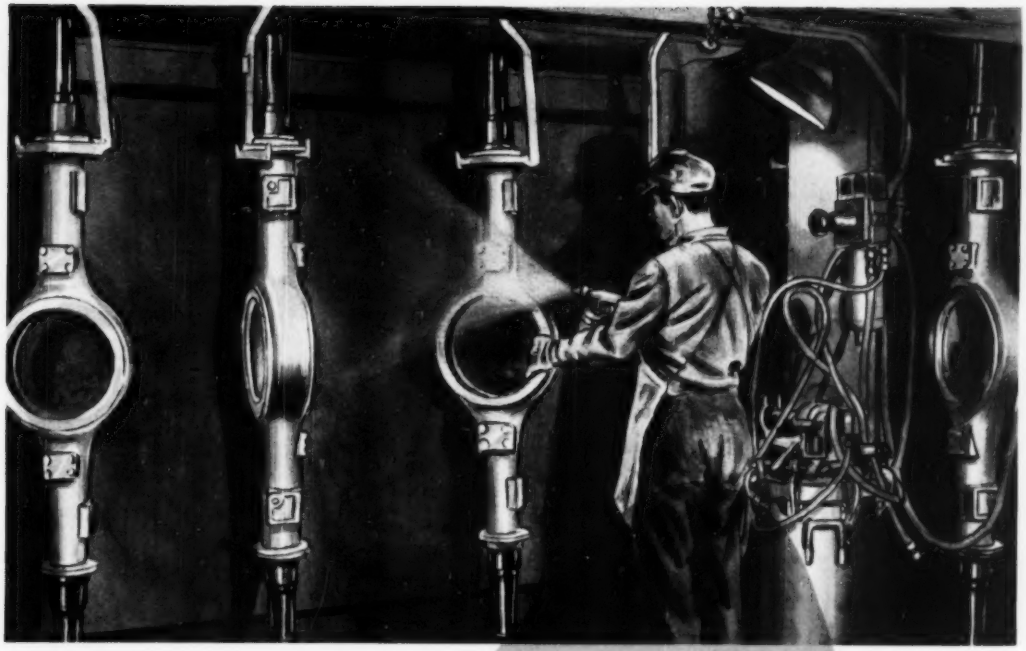

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FOUNDRY FIRM Facts

Hughes Tool Co., Houston, Tex., maintained a perfect safety record for two consecutive years by going through 1949 and 1948 with no lost time accidents of any sort. Other companies with unblemished records in 1949 recently cited by the Steel Founders' Society were: **Calumet Steel Castings Corp.,** Hammond, Ind.; **Gunite Foundries Corp.,** Rockford, Ill.; and **Skagit Steel & Iron Works,** Sedro-Woolley, Wash.

Nash-Christian Foundry Supply Co., Birmingham, Ala., was back in production within six weeks after being razed by fire. The company has manufactured foundry facings for over 40 years.

Buckeye Products Co., Cincinnati, has just completed its second plant expansion since the end of the war. The additional manufacturing and warehouse facilities are required by the demand for the company's facings and other foundry supplies. Buckeye erected a new boiler plant and modern offices in 1947.

After 35 years at 120 Broadway, in downtown New York, **Metal & Thermit Corp.** is moving its general offices midtown. Address since May 1 is 100 East 42nd St., New York 17.

Foundry Div. of Eaton Manufacturing Co., Vassar, Mich., has received a certificate from the National Safety Council in recognition of its outstanding achievement in reducing the frequency of disabling injuries during the period July 1, 1948, through June 30, 1949.

New York offices of **Raybestos-Manhattan, Inc.,** have been located at 500 Fifth Ave., corner of 42nd St., since April 15. Previous location for over 25 years was the Equitable Bldg. at 120 Broadway.

S-K-C Research Associates, with laboratories at 445 Fifth Ave., Paterson 4, N. J., has been organized by John D. Shaw, Walter V. Knopp, and Catherine L. Clark. The new organization will undertake research, technical consultation, and development in metallurgical, mechanical, and chemical engineering, process and plant design, and powder metallurgy.

Automatic Transportation Co. is represented in Pittsburgh by Lyall N. Crissman Co. which has opened a new showroom and sales office at 314 Boulevard of the Allies. Crissman's former address was 2006 First National Bank Bldg., Pittsburgh.

Kennedy Valve Mfg. Co., Elmira, N. Y., recently purchased the **Semler Co.,** Jeanette, Pa., manufacturers of cast iron pipe fittings. Purchase price and future plans have not been disclosed but it is announced that manufacturing operations will be continued at the Jeanette plant. New officers of the Semler Co. are president, Charles F. Kennedy; vice-presidents, J. Lawrence Kennedy and Howard P. Semler; and controller, Thomas S. Turkington. The Semler Co. has some 220 employees and has been manufacturing cast iron fittings since 1915.

Burndy Engineering Co., Inc., New York, announces the mechanization and expansion of its non-ferrous foundry, which will be partially devoted to jobbing work in addition to production of electrical equipment for utilities. Features of the new 18,000 lb-per-day foundry are batteries of double grinders, a blast cleaner, high-speed pouring trolleys and a continuous sand feeding system to overhead hoppers. Complete with pattern shop, the Burndy foundry is producing brass, bronze, and aluminum alloy castings.

Lebanon Steel Foundry, Lebanon, Pa., recently received an award of merit from the American Association for State and Local History for publication of "Lebanon County Through the Centuries," a 36-page illustrated pamphlet.

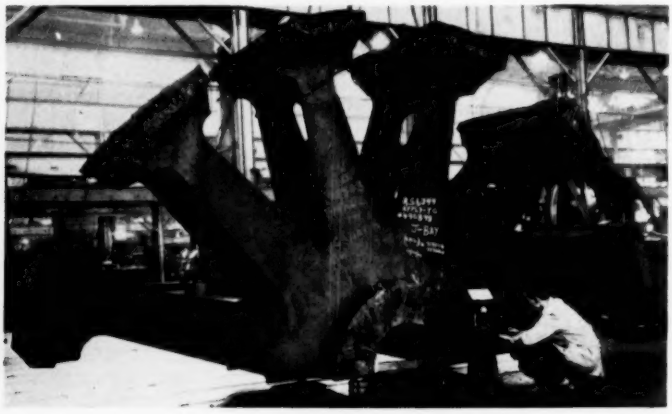
Hansell-Elcock Co., Chicago, recently completed a 20,000 sq ft pattern storage building to replace facilities destroyed last year by fire. The new structure is equipped with overhead cranes and controlled temperature facilities. In the foundry, an entirely new, mechanized sand system has been installed as part of a $300,000 mechanization program.

Lee C. Wilson, Reading, Pa., has opened an office at 716 Washington St., Reading, under the name of Bearings, Inc., handling anti-friction bearings. Mr. Wilson served as President of A.F.S. in 1944-45, and until recently represented several castings manufacturers in the East.

Mine and Smelter Supply Co., Denver, Colo., has been named exclusive representative in the Denver and El Paso, Texas, territory for **Hydro-Line Mfg. Co.'s** air and hydraulic cylinders.

Metalloy Corp., Minneapolis, a division of Lithium Corp. of America, has just completed a plant reconstruction and expansion program. The extensive rebuilding program was needed to give additional plant space and to provide more modern, faster machinery, and to repair damage from a recent fire.

Use Resistance Strain Gages To Weigh Large Casting



Resistance wire strain gages facilitate weighing of this huge 35-ton semi-rotor casting made by Baldwin Locomotive Works, Philadelphia, for a Canadian hydroelectric plant. The gages are bonded to short vertical columns incorporated in three load cells, each of 50,000 lb capacity, for precision weighing.

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CHAPTER ACTIVITIES

(Continued from Page 73)

Central New York

William D. Dunn
Oberdorfer Foundries, Inc.
Chapter Vice-Chairman

NEW SLATE of officers and directors for the 1950-51 season is:

Chairman, David Dudgeon, Jr., Utica Radiator Corp.; *vice-chairman*, William D. Dunn, Oberdorfer Foundries, Inc.; *secretary*, D. J. Merwin, Oriskany Malleable Iron Co.; *treasurer*, J. F. Dobbs, New York Air Brake Co.

Directors (to serve three years): Bruce R. Artz, Pangborn Corp.; John F. Livingston, Crouse-Hinds Co.; and George E. Hochsegang, Straight Line Foundry & Machine Co.

Eastern New York

George Danner
American Locomotive Co.
Publicity Chairman

APRIL MEETING of the Eastern New York Chapter of the American Foundrymen's Society was in the form of a joint meeting with the American Society for Metals. This was the first joint meeting of the ASM and A.F.S. and the officers of both groups expressed a desire to make it an annual affair. The subject of the evening was *"A Technical and Practical Discussion of Ductile Cast Iron."* The speaker was Prof. Howard F. Taylor of the Department of Metallurgy, Massachusetts Institute of Technology. The subject was of interest to both groups and Prof. Taylor proved to be an interesting and entertaining speaker. A discussion period followed the talk with many members taking part. The meeting was exceptionally well attended and provided an opportunity for many acquaintances to be renewed.

Northwestern Pennsylvania

Earl M. Strick
Erie Malleable Iron Co.
Chapter Secretary

NEARLY 100 MEMBERS and guests heard A.F.S. National Director Fred G. Sefing, International Nickel Co., New York, speak at the April 24 meeting on casting soundness as affected by gating, risering and porosity.

Mr. Sefing stated that all gates and risers should be designed with the principle of progressive freezing in mind, i. e., thinnest sections and coldest metal freeze first; heaviest sections and hottest metal freeze last and can be fed by the riser.

Mr. Sefing's talk covered sound castings production, cleanliness, pouring, gate design, feeder design and prevention of gas in metals.

Delegations from Grove City, Mead-

Entertainment and fellowship were features of the April 14 meeting of the Southern California Chapter. Speakers' table occupants were: Emil Peschke, Reliance Regulator Div., American Meter Co. (not shown); Treasurer Henry W. Howell, Howell Foundry Co.; Earl Anderson, Enterprise Iron Works; A.F.S. National Director Robert Gregg, Reliance Regulator Div., American Meter Co.; Vice-President John E. Wilson, Climax Molybdenum Co.; L. P. Robinson, Werner G. Smith Co., Cleveland, speaker of the evening; President Earl Schomaker, Kay-Brunner Steel Products Co.; Secretary Harold Pagenkopp, Angelus Pattern Works; and Leonard Hofstetter, Brumley-Donaldson Co. Messrs. Earl Anderson, Robert Gregg and Leonard Hofstetter are all Southern California Chapter past presidents.

ville and Butler, Pa., and Jamestown, N. Y., to hear nominations for 1950-51 officers and directors, they are:

Chairman, Frank Volgstadt, Griswold Mfg. Co.; *vice-chairman*, Douglas James, Cooper Bessemer Corp.; *secretary*, Earl Strick, Erie Malleable Iron Co.; and *treasurer*, Fred Carlson, Weil McLain Co.

Nominated directors to serve three year terms are: Joseph Shuffstall, National Erie Co.; C. S. Ban, American Brake Shoe Co.; Dewey Davis, Urick Foundry Co.; and Bailey Herrington, Hickman, Williams & Co., Inc.

Canton District

Alexander Prentice
Stark Foundry Co.
Chapter Reporter

NEW OFFICERS and directors of the Chapter were installed at the group's final dinner meeting of the season, held at the Mergus Restaurant, Canton, April 6.

New chairman is Thomas W. Harvey, Pitcairn Co., who succeeds George M. Biggert of the Canton plant of the United Engineering & Foundry Co.

Other newly-elected officers are: *vice-chairman*, C. B. Williams, Massilon Steel Castings Co.; *secretary*, Dale Crumely, Pitcairn Co.; and *treasurer*, Fred Basler of A. P. Greene Fire Brick Co.

New directors are: Ernest Lancashire, Union Metal Mfg. Co.; R. L. Fasig, Ashland Malleable Iron Co.; and John Kerr, Jr., Deming Co.

Following the elections, W. T. Cole of Canton Malleable Iron Co. showed the Malleable Founders' Society's film, *"This Moving World."*

Concluding the meeting, H. F. Randolph, Mexico Refractories Co., spoke on the history and development of refractories and their applications to foundry practices.

Western New York

Roger E. Walsh
Hickman, Williams & Co., Inc.
Chapter Secretary

OFFICERS AND DIRECTORS elected and installed at the May 5 meeting of the Chapter are:

Chairman, Alfred A. Diebold, Atlas Steel Castings Co.; *vice-chairman*, Erwin Deutschlander, Worthington Pump & Machinery Corp.; *secretary*, Roger E. Walsh, Hickman, Williams & Co., Inc.; and *treasurer*, Martin W. Pohlman, Pohlman Foundry Co., Inc.

Directors (to serve three years): Joseph M. Clifford, Bison Castings, Inc.; William H. Oliver, American Radiator & Standard Sanitary Corp.; Joseph H. Sander, Tonawanda Electric Steel Castings Co. To serve one year: Retiring Chairman John R. Wark, Wark Foundry Supply Co.

Chairman Diebold was installed by

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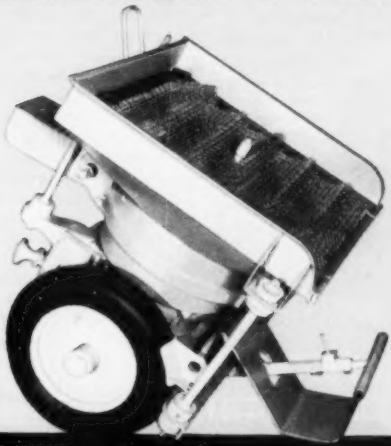

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Transverse Core Tester Rapidly determines transverse strength of sand cores.

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Sand Mixer For thorough preparation of sample core-sand mixtures.

Sand Washer The easy-to-use method to determine clay content of sand.

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Frank E. Bates, Semet Solvay Div., Allied Chemical & Dye Co.; Vice-Chairman Deutschlander by Arthur Suckow, Symington-Gould Corp.; Secretary Roger E. Walsh by Leo E. Merryman, Tonawanda Iron Corp.; Treasurer Martin W. Pohlman by Theodore H. Burke, Worthington Pump & Machinery Corp.; and the new directors by Reinhold D. Loesch of Lake Erie Foundry Co.

A.F.S. National Directors Martin J. O'Brien, Jr., Symington-Gould Corp., and Lloyd D. Wright, United States Radiator Corp., were introduced. Mr. O'Brien presented Outgoing Chairman with a Past Chairman's pin.

Secretary Walsh announced that Frank E. Bates found it necessary to resign as editor of the chapter's monthly bulletin, the *Sound Caster*, because of the press of business matters, and announced that Jack Heysel of E. J. Woodison Co. would take over as editor. Mr. Bates turned over a scrapbook containing a photographic history of the chapter to Secretary Walsh.

After the installation of officers and business meeting, 88 members and their guests enjoyed a smorgasbord dinner and a motion picture on hunting and fishing, shown through the courtesy of Jack Heysel.

Massachusetts Institute of Technology

Richard A. Poirier
Technical Secretary

APRIL MEETING featured a talk by Charles W. Briggs, Steel Founders' Society of America, on the *"Flow of Steel,"* in which he outlined the problems and research being conducted on the flow of steel in molds.

The effects of various sizes and shapes of gates, as well as their arrangements, are being studied to determine the effectiveness of each. Such results as showing the nozzle effect of some types of gates and the mold erosion caused by such gates, will indicate to the foundryman the proper method of gating. The advantages of using multiple and tangential gates were explained.

The question period brought a number of questions, particularly in regard to the analogy of the flow of other fluids to the flow of steel. Mr. Briggs indicated that other fluids are not satisfactory because steel does not "wet" the surface of the mold and other fluids do not have the same erosion effect on sand as does steel.

Detroit

Vaughn C. Reid
City Pattern Foundry & Machine Co.
Chapter Vice-Chairman

ELECTED OFFICERS and directors of the chapter for 1950-51 are:

Chairman, Jess Toth, Harry W. Dietert Co.; *vice chairman*, Vaughn C. Reid, City Pattern Foundry & Machine Co.; *secretary*, Julian N. Phelps; and *treasurer*, E. J. Passman, Frederic B. Stevens, Inc.

Directors (to serve three years): C. W. Hockman, Cadillac Motor Car Co.; H. G. McMurry, Ford Motor Co.; and

Officials of the A.F.S. Philadelphia Chapter, photographed at the Chapter's March meeting, held at the Benjamin Franklin Institute were, left to right, front row: Chapter Directors J. L. Furey, C. L. Tinsley, U. S. Pipe & Foundry Co.; and A. Kraft, General Steel Castings Corp. Back row, left to right: C. L. Lane, Florence Pipe Foundry & Machine Co.; Vice-Chairman C. B. Jenni, General Steel Castings Corp.; Secy.-Treas. W. B. Coleman & Co.; Chapter Chairman W. A. Morley of Olney Foundry Div., Link-Belt Co.

John J. Watson of the C. O. Bartlett & Snow Co.

Following the election, the technical session consisted of the outstanding developments presented at the 1950 A.F.S. Convention. Robert B. Melmoth, Ford Motor Co., spoke on *"Nodular Iron;"* Ray Wilcox, Michigan Steel Castings Co., spoke on *"Steel & Malleable Developments;"* Vaughan C. Reid, City Pattern Foundry & Machine Co., spoke on *"Non-Ferrous Development;"* Frank Brewster, Harry W. Dietert Co., spoke on *"Sand Developments;"* Ted Giszczak, American Foundrymen's Society, spoke on *"Physical Properties."*

This meeting was Sustaining Membership Night, and the sustaining members were well represented.

Missouri School of Mines

James B. Templeton
Chapter Reporter

GUEST SPEAKER at the April 19, meeting was R. H. Jacoby, Chief Metallurgist, Key Co., East St. Louis, who spoke on *"The Young Engineer and the Foundry Industry."*

In his introductory remarks Mr. Jacoby cited examples of young engineers who had come to work for Key Co., pointing out that these men in a relatively short time had attained positions ranging from consultant to works superintendent.

Pregraduation training is important. This training involves working summers at any job in a foundry. This plus your attitude on the job are factors which a future employer will consider before putting you on his staff, the speaker said.

In applying for a job, the graduate should try to get a personal interview rather than just send a letter of application, Mr. Jacoby said. During the interview, "sell yourself" but recognize your limitations, the speaker advised. Concerning salary, Mr. Jacoby suggested starting at 5 to 20 per cent below the rate received by the top labor class, and in approximately 3 years work up to a line foreman's rate.

On the job in the foundry the graduate's training starts again, Mr. Jacoby said. The importance of being a good listener, sincerity and application toward the job, using discretion in asking questions, not playing politics, and an agreeable personality were stressed by the speaker as valuable assets in succeeding at any job.

Off the job one should have memberships in various associations and activities, should read of developments in his field, make plant visitations and observations in order to keep abreast of the ever-changing foundry industry.

In conclusion, the speaker cited the advantages of an engineering back-

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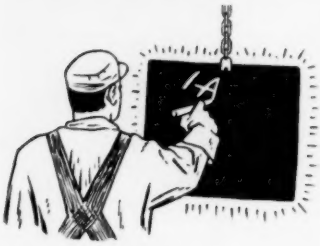

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AMERICAN FOUNDRYMEN'S SOCIETY

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ground and their importance in the future of the foundry industry.

Meramec State Park was the site of the MSM chapter's annual picnic, held April 22. Baseball and corkball games produced the main sources of entertainment for the group.

May 4, Elmer Braun and Richard Martin, Central Foundry Div., General Motors Corp., Danville, Ill., were the evening's speakers. *"Progress Through Better Methods"* was the topic of the evening. Demonstrations of how time and motion studies could help attain better production were presented. Following the demonstrations the GMC film *"Progress Through Better Methods"* was shown.

Michigan State College

William I. Dieters
Secretary-Treasurer

BIG EVENT of the May meeting was the election of officers for the coming year. Edward Fauth handed down his chairman's gavel to Fred W. Schwier. Donald I. Huizenga retained his vice-presidency and Fred Schwier, newly-elected president, turned his secretary-treasurer duties over to William I. Dieters. Kenneth Spray and Donald Davis are to represent our Chapter on the Engineers' Council and Professors A. J. Smith and C. C. Sigerfoos are again our faculty advisors.

An inspection trip of Chevrolet Gray Iron Foundry at Saginaw was suggested and arrangements made.

Central Michigan

F. P. Tobakos
Albion Malleable Iron Co.
Publicity Chairman

OVER 60 MEMBERS and guests attended the April meeting, held at the American Legion Clubhouse in Battle Creek, to hear W. B. McFerrin, Haynes-Stellite Div., Union Carbide & Carbon Corp., speak on *"Casting Defects."*

With the aid of slides, Mr. McFerrin was able to visually illustrate many casting defects he has encountered, explain what the defects were, and then give solutions by which they could be corrected. He said the one factor which could influence the greatest number of defects was the method of pouring iron. To avoid defects caused by pouring the iron should be poured from approximately the same height, should be eased into the mold, the stream should not be broken, and the sprue kept always full.

There should be a definite plan of attack in solving casting defects. Mr. McFerrin suggested three steps to be taken in considering the defects: (1) call in all the organization dealing with the casting; (2) have an open and unbiased mind; and (3) consider all the facts and the equipment used.

Al Rhoads, Engineering Castings, Inc., was technical chairman.

Following the technical session, a film was shown illustrating the campus and campus life at Michigan State College. One of the scenes in the picture showed the pouring of iron in the foundry laboratory at the college.

Thirty-two members of the Central Michigan Chapter attended the Sand School conducted by Frank Brewster of the Harry Dietert Co., Detroit, on April 26, 27 and 28 in Marshall, Mich.

During the three day course, Mr. Brewster, with the aid of slides, discussed each of the various properties of different sand mixes, and their effect upon casting quality. Those particular casting defects which could be attributed to sand were taken up in detail, and remedies suggested for each.

Mr. Brewster emphasized the importance of proper control of sand through tests in the laboratory, and listed precautionary measures to be taken during the running of each of the several tests. In the Friday afternoon session, movies were shown illustrating the recommended procedure in running high temperature tests.

So that those foundrymen in attendance could bring up their individual problems, the final evening session was given over entirely to informal discussion. Several members presented their problems, which were then analyzed and remedies suggested.

Mo-Kan

Thomas F. Shadwick
Witte Engine Works
Chapter Reporter

SPARKED BY MEMBERS planning to attend the 54th A.F.S. Foundry Congress & Show, the May 3 meeting provided a profitable evening of business, fellowship and technical information. New chapter officers were elected and installed and the technical session was conducted by Kenneth Rose, professor of metallurgy, University of Kansas.

Retiring Chapter Chairman J. T. Westwood, Blue Valley Foundry Co., read a detailed report of chapter proceedings for the last year. The chapter then voted to line up all future meetings to enable speakers to include the chapter on their speaking schedules. Majority of future meetings are scheduled for the second Wednesday of each month.

Chapter Treasurer Herman Swickrath, Prior Brass Mfg. Co., reported that the chapter is in good financial condition and commended members for their assistance in making the chapter's first year a success.

Chapter Secretary Charles Myers of Morton, Myers & Co., presented the slate of 1950-51 officers and directors of the chapter, who were elected by the membership:

Chairman, Leslie Neville, Neville Foundry Co., North Kansas City, Mo.;

vice-chairman, Henry Deterding, Sonken Galamba Co., Kansas City, Mo.; and *secretary*, J. Weeks, Independence Stove & Furnace Works, Independence, Mo. Elected to serve one year on the Board of Directors is Retiring Chapter Chairman J. T. Westwood.

Ray Frick, American Brake Shoe Co., was appointed to fill the unexpired term of Chairman Leslie Neville on the Board of Directors, and John Redmond, Jr., was elected to serve for three years on the Board.

Speaker Kenneth Rose presented an interesting experiment on the solidification of metal crystals, in which he set up a screen and projector to demonstrate dendrite growth in molten metals. As the speaker projected each sample for study, he called attention to the differences in dendrite growth in various metals and the formation of gases that, he said, cause porosity in metal structures.

Mr. Rose explained that the tree-like dendritic crystals never make a solid metal, but that metals with a fast primary solidification generally have fine grain structures.

The speaker pointed out how to overcome porosity by keeping metal in a molten state and feeding it with new metal during solidification. The meeting ended with questions and answers.

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APPROXIMATELY 275 members and guests attended the meeting April 13. Guests included a group of local apprentices who had taken part in the recent molding and patternmaking contest sponsored by the Associated Industries of Cleveland. Fred J. Pfarr, chapter vice president, presented checks to the prize-winning boys in the casting division. Peter Rettig, chairman of chapter's pattern group made the presentation to the boys in the pattern-making division.

Following a brief address by Wm. W. Maloney, A.F.S. secretary-treasurer, the audience was divided into three sections to hear discussions on core blowing, refractories and patternmaking.

The description of core blowing was presented by Z. Madacey, foundry superintendent, Caterpillar Tractor Co., Peoria, Ill. According to the speaker, successful practice depends upon several major factors including accurate sand control.

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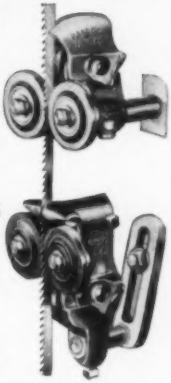
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Approximately 50 members attended the session on refractories under the direction of John Manos, Lake City Malleable Co., Cleveland. First speaker, E. G. Petry, North American Refractories Co., Cleveland, discussed refractories for malleable furnaces and pointed out that roof or bungs, side walls, bottoms, and bridges serving under different conditions require refactories of different characteristics. For example, the bung brick should have high spalling resistance, the side wall brick should possess slag resistance, and the bottom brick must be resistant to metal penetration.

Second speaker, S. M. Swain, North American Refractories Co., dealt with cupola refractories. Those, he said, operate under constantly changing conditions including high temperature, complex slag, etc. Spalling condition, he believed, always was present. He pointed out that refractories suitable for operation in one foundry might not do as well in another, or even in different cupolas in the same foundry, and hence from time to time it is well to study the situation to determine whether refractory change is indicated.

At the patternmaking session a panel of experts including Ed Glosmer, Modern Pattern Co., chairman; Albert Trhlik, John W. Wilbur Co.; Louis Schmidt, Aluminum Co. of America; Ed. W. Pierie, Motor Pattern Co., and Charles Wilburcheid, Master Pattern Co., all of Cleveland, discussed patternmaking questions which had been submitted by a number of apprentices. A number of apprentices were present to participate in the discussion.

New officers and directors of the chapter, elected May 25, are:

President, Fred J. Pfarr, Lake City Malleable Co.; *vice-president*, Gilbert J. Nock, Nock Fire Brick Co.; *secretary*, A. J. Harlan, Hickman, Williams & Co., Inc.; *treasurer*, F. Ray Fleig, Smith Facing & Supply Co.

Directors (to serve three years): R. J. Hines, Hines Flask Co.; S. E. Kelly, Eberhard Mfg. Co.; J. J. Kroecker, Aluminum Co. of America; M. C. Ross, Bellville Foundries, Inc., Bellville, Ohio; and C. F. Walton, Case Institute of Technology.

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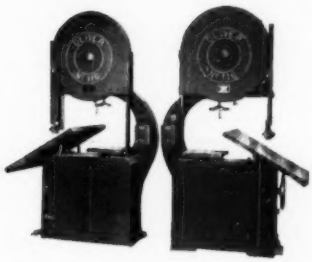

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DINNER MEETING, held April 11 at Hotel Freeport, Freeport, Ill., featured a talk by B. C. Yearley, National Malleable & Steel Castings Co., on *"Cracks and Tears in Ferrous Castings."*

Mr. Yearley summarized briefly what is known about cracks and tears in castings. He first pointed out that in the transformation from the liquid to the solid state the metal volume changes about 3 per cent. This change in volume is taken care of by proper feeding. An additional reduction in volume takes place in cooling down to room temperature. In terms of linear dimensions the volume change from 2000F to room temperature is equivalent to a change of approximately 0.015 in./in. of length.

Thus a 10 in. cast bar would shrink 0.15 in. in cooling from 2000F to room temperature, provided the change is unrestricted. In a like manner, castings must change dimensionally in cooling to room temperature. This means that either the sand or core must yield to the casting or the casting must yield to the sand.

Still another cause of hot tears may be the metal analysis or melting practice, for it is known that the sulphur, phosphorus, and manganese have an influence on the ductility of the metal at elevated temperatures.

On the subject of cold cracks, Mr. Yearley stated that they occur at or near room temperature because a force greater than the ultimate strength of the metal is exerted on some portion of the casting due to differences in cooling rates of various sections.

Mr. Yearley pointed out that the elongation in hard iron, for example, decreases from 14 per cent at 1600F to 0 per cent at 1100F and conversely the ultimate strength increases from 8000 psi at 1600F to 68,000 psi at 1100F.

Thus, in a casting made up of sections of different sizes, there would be differences in cooling rates among the various sections. This conceivably could cause one section to create a stress in the other which was beyond the ultimate strength of the section at the elevated temperature and result in a cold crack in the section.

The problem then is to analyze the casting and the cracks to determine what the cooling characteristics of the sections of the casting might be.

The best solution, Mr. Yearley felt, was to put the castings in hot pots to bring all critical sections up to the ductile temperature range and then allow the casting to cool down to room temperature.

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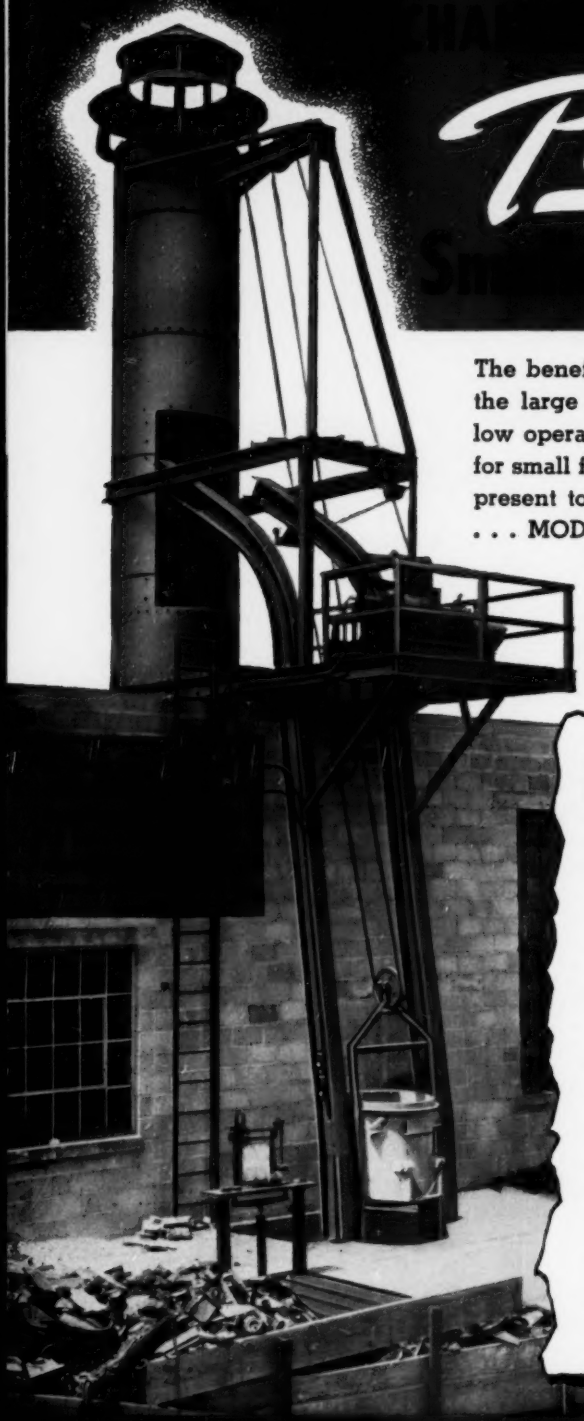

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